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GEMINI V

TECHNICAL DEBRIEFING (U)

Part 1

V

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PRELIMINARY

GT-5 FLIGHT CREW DEBRIEFING TRANSCRIPT

PART I

Prepared By

Spacecraft Operations Branch

Flight Crew Support Division

September 1, 1965

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PREFACE

This preliminary transcript was made from voice tape recordings of the GT-5 flight crew debriefing conducted August 30, 1965 thru September 1, 1965 at the Crew Quarters, Cape Kennedy, Florida.

Although all the material contained in this transcript has been edited, the urgent need for the preliminary transcript by mission analysis personnel precluded a thorough editorial review prior to its publication. Errors in this transcript will be corrected as soon as possible and an official transcript will be published at a later date.

This document contains a transcript of the first part of the debriefing, during which the crew described the mission generally from an operational viewpoint. A preliminary transcript of the remainder of the debriefing will be published by September 3, 1965. It will cover systems operations, operational checks, visual sightings, experiments, pre-mission planning, mission control, and training.

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1.0 COUNTDOWN

1.1 Crew Insertion

Cooper The crew insertion, I thought, went very well.

Conrad Yes, we had the suiting thing down on my cuffs and everything so that we got right out there and, boy, the Gunter was ready for us and in we went.

Cooper They were all set. There were no delays and everything went exceedingly well on the gantry.

1.2 Communications

Cooper Communications, I thought were good and no problem at all on communications, and everything went real well.

Conrad Yes, Stoney handled that whole thing real well.

Cooper All right, volume was still down on the little comm sets in the transfer van there. That's Stoney's little improvement.

1.3 Crew Participation in Countdown

Cooper Crew participation in the countdown was good. I didn't see anything at all wrong.

Conrad Yes, we weren't rushed. We felt that we had enough time to get the switches in the right position and just everything went real good.

1.4 Comfort

Cooper Comfort was real fine. We went on to two suit fans

right away. I thought we felt plenty cool the whole time.

1.5 ECS

Cooper ECS was good. Never any problem with it.

1.6 Sounds

Cooper Sounds, I thought the only sounds that we had that were abnormal we'd been warned about. When the prevalves opened, they were fairly loud and when the engines gimballed they were quite loud, and both of those we were aware of the fact that they would cause a lot of noise and vibration.

Conrad There is something that really dings the booster too when they start.... I don't--whether they drop a platform away.

Cooper It's before they start moving the gantry.

Conrad Just before they start lowering that erector. Boy, something really, like it really bangs that booster, I thought. I still don't know what it is, but, of course, we'd been up there with the erector down twice before that so we were sort of getting used to those kind of sounds.

1.7 Vibration

Cooper Okay, vibrations we already covered that. Sounds, vibrations.

1.8 Visual

Cooper Visual. Nothing....

Conrad Oh, yes, wait a minute, I started getting this window fogging.

Cooper Well, let's cover that under the right area.

Conrad Well, it was actually in the countdown when the erector went down before liftoff.

Cooper Well, okay, allright.

Conrad I mean we still had it later.

Cooper Well, you want to cover that now then in systems.

Conrad Well, is that what this means, is visual, or does that just mean something else?

FCSD REP Yes, that's before liftoff. Powered flight is next.

Conrad Yes, well this happened before liftoff.

Cooper Allright, even before liftoff, I think that this really is completely unforgiveable. Each window was filthy. Just fogged completely over, and it was on the inside of the outer pane of glass. It was within the sealed unit of glass, and it was so foggy when they lowered the erector that it was just like it was frozen over solid. I couldn't see out of it and neither could Pete.

Conrad Well, it had fogged over before they lowered the

erector and then the guys heated it with hot air to make it go away and that just made things worse when they lowered the erector.

Cooper It didn't make it go away all the way.

Conrad That's right it made it worse actually.

Cooper Now on my side in my window in between the inside pane and the two outside panes of glass, I had a small bee, and I had a fly, and I had several flecks of things that I had written up before and never got corrected, and they were the whole flight, and I'm sure they will show up on all the films and everything. Now between the outer sealed panes of glass there were numerous little specks and of stuff and throughout the flight as...well, we'll cover that later, but that was even before the flight started. The windows were not plain and were not in good shape to go for the flight.

1.9 Crew Station Controls and Displays

Conrad I think the Gemini cockpit is a pretty good cockpit.

Cooper I think in general that crew stations controls and displays were pretty adequate.

Conrad I've got a couple comments on switches and things, but these are....

FCSD REP Okay, how about the time you spent in there on prelaunch. Do you think that this is about right?

Cooper Yes, yes, I think that this is just about right. I think that if you cut it down too much more than that you are going to be....you could cut it down some more, there's no doubt....

Conrad It's that cabin purge cycles when you're not doing anything really, and that's excellent time.

Cooper ...that you can cut it down, but that's the thing that takes the time for both the ground crews... and that's lost time. I don't know....

Conrad I don't think you want to rush the crew and now our count that second day went by the clock, boy. We got in there at the right time. We counted down and lifted off on, and I didn't feel that I was rushed, and I didn't feel that I sat in there for an excessive amount of time.

Cooper No, I didn't either. I thought that it went just about right, time wise.

Conrad Long as there's no holds in the count everything's great.

2.0 POWERED FLIGHT

2.1 Lift Off Cues

Cooper — Okay, lift-off cues, CAP COM. CAP COM didn't come into the act until later. Stoney counted us down thru ignition and lift-off and then CAP COM picked us up at lift-off. Motion is an excellent clue. There's doubt in your mind when you lift-off. You know, the second you lift-off that you've lifted. Vibration was very low.

Conrad — It had dropped out almost completely at lift-off, felt that shaking was very light.

Cooper — There was very little vibration at all. Okay, vibration, very low. Noise I thought, was quite low.

Conrad — I was particularly aware of the noises of going through the max Q regionary thing. Oh, this is lift-off again. I thought the noises were very well at liftoff. You know the engines were running from the outside before, you know, and man they really make a racket, but from where you are it's pretty quite. You know there running. You can here them, there's no doubt about that, but ...

Cooper — Okay, on visual I don't .... We had a very clear day. There weren't even any clouds in sight on

our sight as we were lifting off, and I couldn't tell any visual cues to lift-off, could you?

Conrad You had the feeling that you were moving visually. After you get your roll program you see it visually and you can see the pitch program starting visually, but just at first lift-off you don't really have any visual cues. Cockpit displays are just like advertised. The two stage - one lights go out, and ... just like the simulator.

2.2 Roll Program

Conrad Yes, I watched roll program on the gyro, I was watching for it to come in on time and in glancing up when the roll program started I was still looking at nothing but blue sky, but I was aware visually as you say that the booster was rolling. Yes, you can have a airplane when you are looking at nothing but blue sky and start a motion and you may not know exactly what the motion is, but you know that you are moving.

Cooper Now on this cockpit display, something that I got two different answers to from different people on how the gyro and the actual case was going to be set and it suddenly dawned on me that they actually set the gyro so that you are launching down the 90 degrees. You're

progressing down to 90 degrees line, a la the simulator, although the booster sets on 85 degrees and when you turn to 72 degrees launch azimuth you are rolling clockwise so far as the crew is concerned.

Conrad — You roll to zero.

Cooper — But you are rolling to is really to 0 on the gyro as precessed around so that you are not really setting on the actual launch azimuth, you are actually setting so that when you stage on over in yaw then pitch over then in your yaw your on the in-plane line.

FCSD REP — You're coming down the zero line. You're yawing down the zero line.

Cooper — That's right, and I kept getting different answers on this and this is in fact the case. Roll program was exactly right on time and ended exactly on time.

2.3 Pitch Program

Cooper — Pitch program started exactly on time.

2.4 Aerodynamic

Cooper — Aerodynamic was nothing new or different about it. It was just standard. We build up to the noises at max Q; the noise built up to gradual level and the vibration and quantity built up to max Q and then dropped off very rapidly immediately thereafter.

2.5 ECS

Conrad Right on the button.

Cooper ECS was right on the money, no problem at all. Max Q we've already stated.

Conrad The cabin sealed a little bit high like they said it would. I forget the number. It was about 5.8.

Cooper About 5.8 or 9 and just gradually dwindled back down.

Conrad And just after we got in there by the time I looked at it again after insertion everything it bled down on our gage to 4.9, our gage read a little low. I think the actual reading, you will probably find the cabin actually was 5.1, but the whole rest of the flight the gage never budged off the 4.9.

Cooper The gage stayed right there like it was glued.

2.7 Wind Shear

Cooper The wind shear, we had none and, certainly nothing that we could tell, but as I understand we've been told that for that day anyway we had almost negible wind shear.

2.8 DCS Updates

Cooper DCS updates were right on time.

FCSD REP You had two updates?

Conrad 1 plus 45, 2 plus 25.

2.9 Engine 1 Operation

Cooper The engine 1 operation couldn't have been better,

It was beautiful. Just now in between engine 1 operation and engine 2 here we have two items we will insert in here.

2.10 POGO

Cooper One was POGO. At 2 minutes and 5 seconds we started picking up POGO and I got a fairly good amount of POGO on through, stopping just at about 5 to 7 seconds before staging. POGO dropped clean out exactly the same time there that we programmed POGO on the early days.

Conrad Yes, that one surprised me. We'd heard and read that both John and Gus's and Jim and Ed's flight that they were hardly even aware of POGO and boy when it came in on us it was loud and clear and, well Gordon, neither one of us could talk hardly; we were really vibrating with it and I was hard pressed to read the displays. By golly, if I had to read the number on the displays I think I would have been hard pressed to do it, because we really had it pretty good.

Cooper Yes, the rate ... the amplitude of them were such ... 11 cps frequency and the amplitude of them was such that you were on -- you were on the marginal

edge of reading of any large gage and any fine reading that you had to read, you would never be able to read any numbers. It was exactly like the POGO we did all along on the program up at Ames and as the exact amplitude, I don't know, but it was, ... I think we don't want that kind of POGO. It was not particularly upsetting to me, because I really was fairly familiar with POGO having been through all that POGO program, but this thing kind of tickled me that we got it to see that we had still hadn't solved it, but I don't think ... its something you don't want because if you had other things going wrong during that period of time it would make it very difficult to say what you had wrong or what ...

Conrad It didn't upset me, but it surprised me, you know, because I just wasn't expecting POGO.

RCSD REP What g-level would you estimate it to be?

Cooper Well, we were sneaking right up there.

FCSD REP I mean the POGO.

Cooper Oh, it was right at about 5 g's.

FCSD REP Well, I mean plus or minus amplitude.

Cooper Well I, my estimate on it was that it was something

on the order of maybe three quarters of a g. Well, I don't know whether it was that high or not.

Conrad I thought it was at least a half, if not better. Apparently it wasn't that high. I was really surprised. Like I say, we were really getting the ramrod out of it.

Cooper It was beyond what we selected as we thought should be the cutoff. It was more than what we had selected at Ames as being max acceptable. Also in this, I passed up very briefly there one of the first things that happened immediately about the time that we got the pitch program was the IGS Stage 2 fuel needle failed in the full-max deflection position. And it came back on and was reading after staging briefly and then failed again during staging. It was intermittent.

2.11 Engine 2 Status

Cooper Engine 2 status stayed ... was perfect. There was not anything wrong at all.

2.12 Acceleration G's

Cooper Acceleration g's were right on the profile, were certainly very pleasant. Nothing wrong at all with them.

2.13 BECO

Cooper BECO was right on the money.

2.14 Staging

Conrad Boy, that staging was smooth too.

Cooper They told us that BECO was going to occur early, but it was ....

Conrad We did loft a little bit apparently like they said we would because, right after staging ....

2.15 Engine 2 Ignition

Conrad Well, Engine 2 ignition, I wasn't even hardly aware of that other than we just started to get a little, you know, we just sort of went off the peg at 6 g's and Gordo said staging OK and Engine 2 is good and I wasn't even aware that Engine 2 had lit. You can't hear it, to speak of, but you can feel the acceleration slowly building up.

FCSD REP Did you see anything visually?

Conrad No, I didn't see anything. I heard the other guys talking about see the flash at the brig. Never saw a thing and I wasn't aware of any flash out there either.

Cooper I didn't see anything at all at BECO. The best clue that I have on my side, is that I see the Fuel and Oxidizer needles start coming down as the engine

starts burning. And then they coming down fairly rapidly at first, I mean you get a very definite motion on them right at first there and they kind of settled out. Engine 2 ignition we've already covered.

2.16 RGS Initiate

Cooper RGS initiate right on the money.

Conrad I was going to mention that we had lofted and that we were expected to pitch down and we did when it picked up RGS.

Cooper It smoothed in very smooth, and the fading was just right.

Conrad The IGS needle really deflected and I was, you know, I don't think it pitched, it didn't peg out, but it did make a large dip and then when the booster came down just pitched down very smoothly down to about 75 or 80 degrees, I guess it pitched down almost 10 degrees.

FCSD REP What rate did it pitch over?

Conrad Very slow, but steady, at just ....

Cooper It took about 20 seconds I guess to fade it in there.

Conrad The needle came in and made a big deflection and right after that the booster started pitching and the needle started back and boy the needle was

back and thing was right on the money at about 80 degrees. It was a very smooth transition and then do you remember they were telling us to look for this one cps oscillation? Well, I didn't have rate needles like Gordo did, but I wasn't aware of any oscillations at any time. That booster was in pitch and yaw as far as that went ....

Cooper Those rate needles were like they were glued . There was never through boost or second stage was there ever any rate except that one tiny little rate, one teensy little rate just at when we were in POGO we got one tiny little longitudinal rate, just one tiny little fleck on a rate, and was the only one. Otherwise it was just smooth as silk, the whole time, rate wise.

2.17 Fairing Jettison

Cooper Fairing jettison. We jettisoned fairings at 3:25 and man do they ever go.

Conrad I counted Gordo down to them. Okay, yes, that's a good point.

Cooper Beside the scanner fairing and the nose fairing go and when the nose fairing went it went with all kinds of debris. There were pieces flying all

over.

Conrad Yes, and I don't think it went right. I don't believe it went right, because the R and R can was ripped up in the front, and I can show you on my side the nose went like that and there was some tape or fiber glass that goes around the .... It was fiberglass cloth and it was all broken loose in jagged flaps sticking up that, you know, had broken loose from along in here when that cover went I had decided impression that the cover went off askew, that it didn't jettison the way it should have. And this could be a good point of putting it back to after insertion.

Cooper Well, it's supposed to go off askew.

Conrad Yes, well, it just didn't go off clean. That's why this was ripped up, see.

Cooper Well, it something somebody might look into, but you don't want to recommend that they put back to after insertion, because your taking a weight penalty to carry that all the way up.

Conrad Yes, I realize that, but ....

Cooper It was designed to go off ....

Conrad That was the reason in the first place that they

moved it up there anyhow, because they weren't ....

Cooper No, the reason they moved it up there was because they didn't have strong enough propulsion on those squibs and spring combinations or whatever they use. We never did get a reading on that, but whatever the total propulsive expulsion system wasn't kicking, the scanner fairing wide enough but what they would come back into the booster. But didn't you have the distinct impression that the nose fairing broke into jillions of pieces when it blast.

Conrad I certainly, I certainly, yes. That's why when I say askew, I mean something didn't look right. I can't put my finger on it, but --

Cooper It came off in many pieces anyway. There were many, many pieces and the whole area was just filled with debris.

Conrad Yes, and then, I'm not sure that that's when we got all that glop on our windshield, the spots ...

Cooper Well, I noted exactly at that time immediately after the fairing went, I noted about 5 or 6, I saw them hit, 5 or 6 gray splots, just small ones, very small little gray-type splots and I was distinctly looking for that and watching for it and

they were not there before they were there and I saw them when they hit. They hit during all this debris flying around period.

Conrad I think that you can still find them on the windshields. They didn't burn off during reentry.

Cooper But they're not bad and there are just a few little scattered ones and I think it might be interesting to compare how many you get there versus and how many you get when you jettison them in orbit. It may well be that jettisoning in orbit would be preferable, but I didn't find anything objectionable to jettisoning where they went, they went fine. It did add a lot of debris and I agree with Pete there was a big torn something or other out there which may just be a fiberglass thing that is kind of ....

Conrad Yes, I want to get down and look at the R and R and and I can tell you what it was, describe it a lot better. We'll probably have some pictures of it too in the camera somewhere. I know it'll show up in some film.

FCSD REP How long was this visible? You say there was a big bunch of stuff out there.

Cooper There's a whole fly. Oh, you mean the debris. It was gone.

Conrad It was gone like that, but it just looked like the whole darn thing exploded.

Cooper It looked like it just flew into a jillion pieces. It was all around you for maybe a period of a second or two.

Conrad I didn't think it was that much, it was just gone.

Cooper But it was a defininite period of time when you were aware of all this debris all over and then clear. Okay, enough for fairing jettison.

2.18 GO/NO GO

Cooper GO/NO GO: We never got a GO/NO GO because we lost our number 1 radio in about 4 minutes sometime just prior ... let see we got a .8 .... We got a V over V_R of .8. We got a GO/NO GO of ...

FCSD REP You did get a .8?

Cooper We got a .8.

Conrad Yes, that comes much later - that comes after the GO/NO GO.

Cooper Yes, that's right, okay, well I don't remember ever getting a ... yea, we did, we got MCC GO. Right we got a GO/NO GO, okay, but then immediately after .8 we never got anything at all from there on until after we were inserted and gone to UHF No. 2.

Conrad I think it must be in the antenna problem, I really do.

Cooper Well, there's some problem there because the same thing happened on one of the previous flights and we definitely and completely lost radio and I switched over just before we inserted. I switched over to number 2 and then when I called out the IVI's we were back with them then.

2.19 Systems Status

Cooper System Status everything ....

Conrad We did have ... Let me describe the delta P lights. Shortly after liftoff I got the number 1 fuel cell delta P light and I reported it and just about the time I reported it, then the number 2 fuel cell delta P light came on. They stayed on all the way through boost and they were on after insertion for ten, fifteen seconds and after that they went right back out again and that was it. It didn't effect anything on the fuel cell operation, the currents, the voltages, everything stayed fine other than their being on there was no other way of telling the ΔP was out of tolerance so I don't think it is a problem. We expected it.

Cooper I'm glad that we had them changed to orange rather than red.

Conrad Yeah, yeah.

Cooper Systems status in addition to that I don't think we had any systems that were exactly right, except the radio and the acceleration as we had expected it. We were right on the profile. SECO was ...

2.20 SECO

Conrad I think we burned out at, Gordo, 7 and 1/4 g's.

Cooper Right. SECO was exactly on time, just exactly on time and IVI's read 002 AFT. Almost perfect.

2.21 Steering

Cooper Steering was ... there was no steering accelerations or velocities that we could tell. Steering was just smooth as silk, apparently they had us going right down the slot. And when we came off, apparently we were lined up well because there weren't any rates because when we came off and waited our 20 seconds there were no rates whatsoever and it was just setting there just .... as smooth as

Conrad As stable as a rock.

Cooper As smooth as silk so that and when we started thrusting and separating we came off just right straight forward. No deviation, no skidding around or anything. Just right straight off.

Conrad I thought the IVI's were plus 2. That's what I have written down here. Plus 28 right, 3 up.

Cooper I guess that's what it was.

FCSD REP This velocity you read?

Conrad I was going to cover that in your ....

Cooper Your right, plus 2, it was -- that's right. Plus

002.

Conrad I have all the computer readouts.

Cooper 008 right and how many up?

Conrad 3 up.

3.1 Post SECO

Cooper MANEUVER CONTROLLER worked fine. We went right through ....

Conrad Well, let's go through that. The way we had practice SECO, Gordo, got SECO and Gordo unstowed the CONTROLLER and I armed the BUS ARM Switch so that we get the MSC-1 doors OFF.

Cooper Brought the propulsion power ON.

Conrad Brought the ATTITUDE CONTROL Electric Power ON. Went from RATE COMMAND to DIRECT. Armed the switch and hit the computer. Armed the sep spacecraft thing and Gordo and I counted the seconds down. In the meantime, I punched off address 72 so that it was reading and then in 20 seconds we had SEP S/C ....

Cooper In 20 seconds I started and I called it out and started thrusting and Pete would hit the sep spacecraft ....

Conrad The reason we did that was so that we would have

the inertial velocity readout on the gage and that was beautiful 25,808 and nominal was supposed to be 25,807. You can't ask for a better calculation from a computer than that, and a lot of people don't have much faith in that thing but, I think that I'll bet that the computed MCC figure isn't more than a foot or two off. It couldn't be because everything was nominal for hours and hours in the past. Day's it went that way where we stayed on the flight plan to the minute, to the second so I know that it was a good computation, and I have the five address readouts that we read. We read out address 72 as 25,808; address 94 which was R dot for gamma was plus 20 feet which is pretty darn small so we must have almost a zero gamma address 97 which is the forward IVI was plus 2 feet; address 52 was perfect, it was zero. So there was no adjustment needed and if there had been an adjustment needed that would have come at 3,042 seconds on the computer if there had been an address. 52 correction and nominal 3,008 seconds so the computer computed the nominal thing off only by less than a minute, about a half a

minute of what the actual nominal value should have been, so I think thats pretty darn good for that ascent routine in that computer, and I think that now that we have Math flow 6 in there this is why I think the guy shouldn't get so darn worried in MCC about underspeeds and giving them burn corrections and going through all this Mickey Mouse. I've been trying to make this point ever since we got associated with ....

Cooper I think we had better immediate data available on board than people have been giving it credit for.

Conrad That's right, and it really pleased me to see it come out on the computer this way.

Cooper And had we never gotten our communications back we would have known that we were in good shape because of the data we had on board, we didn't have to worry about the ground readouts and what to do; we would have known what to do whether we had been under or over or anything else.

Cooper Attitudes and rates, there weren't any rates. The thing was steered right down the slot. We came off smooth.

Conrad Spacecraft separation ....

Cooper We separated as smooth as silk just right straight ahead ....

Conrad Well, we counted down and Gordo said he was ready and I SEP spacecraft and he thrusted and I went back to RATE COMMAND for them and we came straight off. I didn't even feel it. The first thing we felt was thrust.

Cooper And rolled upright and went to 000 00 -15 which happened to be right on the horizon. As it turned out that 15 figure was good. It read out the IVI's.

FCSD REP That's, you know on 4 ... they thought they came off the booster.

Conrad Yes, that's why I mentioned that because ....

Cooper That's what we were looking for, too.

3.2 SECO Plus 20 Seconds

Cooper We've already mentioned the IVI displays. Spacecraft separation occurred very smoothly. Thrusting was smooth, nothing wrong at all. Attitude rates were good.

Conrad Yes, I don't understand this! I don't understand this guy saying that they can't hear them or they can't sense them. Boy, I was easily aware ....

Cooper You can feel them almost more than you can hear them. You can feel them vibrate really, more than you can hear them. I mean, you can hear them too, but the vibration you can hear them too, but the vibration you can feel the thrust.

Conrad Have you ever heard a high speed hose or high speed water jet. Shhh ... That's the impression that I had.

Cooper Yes, that's right.

FCSD REP Even from the aft firing thruster?

Cooper Every thruster we had on there.

Conrad We heard every thruster on the whole flight

Cooper It never occurred in my mind when the thrusters were fired. You can feel them and I can hear them. I couldn't hear them in the sense of an explosive sound or a roar. It sounded like water swishing.

Conrad Yes, very definitely, more a Shhh.

Cooper And I was aware of it again when we made the burns later on, you know, we made the reverse coelliptic stuff and all that. ....

FCSD REP How did these noises, the thruster noises, sound compared with the way the last crew set the mission simulator?

Conrad Hey, that's another interesting point.

Cooper They're not very close on pulse.

Conrad Pulse is a ...

Cooper Pulse is more of a thump.

Conrad That's the one sound that does sound like you'd expect a rocket engine to sound.

Cooper Here's a sound just about like this: (knock)

Conrad Yes, it very definitely sounds like a knock. There is no "shhh" or roar, just a little thud.

Cooper You can hear it just like somebody knocking at the back of the spacecraft. You can hear it go "tap tap, tap, tap, tap, tap,"

Conrad Really, the simulator doesn't sound the right way. It's a general enough nature and it the same type manner ....

Cooper Yes, it is close enough to give you a good cue.

Conrad The platform mode for instance, you know, when it goes shh, shh, shh, shh ... did the same thing in the spacecraft except it was all in one thump and swooshes when it was constantly firing the thrusters it sounded like the swish.

Cooper The air-to-ground communications I thought was excellent the whole time. I didn't find anything

wrong.

Conrad We really had good comm the whole flight.

Cooper There was never a time -- the only time -- the only fault we find was one or two times through the remote site when the MCC was trying to remote to these sites they would get some fading. I must say the HF worked excellent. When they were transmitting music, broadcasting music to us, my gosh they had us practically the world round on the HF section. The music quality was quite good in most cases.

Conrad I got times on that we can bring out later so that they can correlate how far ....

Cooper GO/NO GO, there wasn't any problem on that. They gave us the GO right away.

FCSD REP How long did it take them to give this?

Cooper Oh, heck, immediately. Almost immediately.

Conrad There was no swivel (sweat) because there was no velocity correction.

Cooper There was no velocity correction needed. Orbit quantitites were good, they had those for us. It took them quite a while to read us our experiments but they just said you have a nominal orbit and then maybe ....

Conrad I've got down here the GMT of liftoff. I wrote down 13 plus 59 plus 59 which they later change to 14 plus 00 plus 00. I have the one A time they got it up to us okay, which was 10 plus 11. Then I have the 2 dash 1 they gave us was 01 plus 27 plus 16 which they later revised to 01 plus 26 plus 27. I wrote those down.

3.3 Insertion Activities

Cooper Okay, let's start on insertion activities. SAFE the switches we did that just right for our checklist. In fact, we are even more convinced than ever that a good, thorough, accurate, checklist is the only thing to have and ...

Conrad Physically marked them off when they were done.

Cooper We followed it conscientiously. The sequential light tests, we did it just by the tests. Stowage, we already had modified our checklists and we already had written on some of it that we would do these if we decided to. For instance, the D-ring safety pin, we did install them at right time, and there was no problem on those; they were much easier under zero-g to get in and out than we had thought and I had no

trouble getting my D-ring in, did you?

Conrad I waited on mine, remember.

Cooper Yes, you waited ....

Conrad I stowed my D-ring thing ....

Cooper So we closed the cover immediately and I decided I would go ahead and see if I could get mine, and I got to it right away and it went right in, so I put it in.

Conrad We, of course, got in trouble in the second orbit, but we did not unstrap or put the drogue pins in the seat or unstow any items of gear other than the flight plan books and the 16mm camera and the Hasselblad. I take it back. We went through the Flight Plan as advertised and then stowed the items. We had D-2 camera out, the Blob out, but we did this in the proper places in the Flight Plan. But we never did unstrap.

Cooper We never unstrapped and never put the drogue pins in until after we go to 6 – 4 GO. We got a 6 – 4 GO.

Conrad But we restowed too, after we got in trouble. We throught maybe having to go into 6-4 why, we'd put ourselves back into the configuration

that was pretty close to being able to reenter

Cooper My arm restraints were never up. I already decided that I was not going to launch with them. They are just useless as far as I am concerned, and I was delighted I did not have them; and I didn't miss them and I don't think, I think personally you could remove them and ...

Conrad The arm restraints are there for the pressurized case and high altitude ejection. I did go with mine up. I would prefer to go with them down, but there wasn't any reason, I didn't need to get my hands on the hand control or anything so I left them as they were, but I don't think they were necessary.

Cooper Okay, belts. I couldn't find anything wrong with the belts. The harness - While we're on the harness, I don't like that harness worth anything. I personally think what we need is a simple type adjustable type harness with clips on the legs that you can undo the legs to get to some of the functions you have to: urination and defecation and so on in the spacecraft. I don't see why we have to have a big, expensive, custom, made harness that you can't readily get on and off and this one you can not readily get on and off and if you had one with simple adjusting buckles on it and snaps like you do on an airplane parachute harness, it would be, I think, a hundred times useful as this one.

Conrad Let me ask you a question. Do you really - now, do you really - I agree. Let me say this. I agree you should first be able to get your harness on and off, but in zero-g I'm not convinced that three, especially two leg snaps type arrangement. In other words, a harness that would come completely loose and have many straps that hitch to the other straps would be really good in zero-g. What I think we need to do is to be able to get in and out of that harness that we have, easier. Like, maybe you could loosen the leg straps on it but not have them come apart. Now, I

took my harness off in flight twice. I took 'em off once--

Cooper Yeah, but you wouldn't even have to step through these leg loops if you had - just like on an airplane harness. You could undo that and you wouldn't even have to worry about the leg loops. Then all you'd have to do is just slide out of the torso area.

Conrad Yeah. Well, lets see, that's what I'm saying. If you unhook both of those leg loops and you throw the whole thing down in the footwell and then you pull it back up again you got a leg strap floating off over here and you got a--

Cooper Well that's no problem. It's no worse than it is finding your lap belt. Did you ever have trouble getting your lap belt back on after you took it off?

Conrad I always hitched it on the Velcro over on the side.

Cooper But you never had any trouble getting to it. I didn't. I let mine float free and I never had any trouble getting to them at all.

Conrad Well, I just don't know now. I really didn't think it was that bad getting in and out of this harness. My only concern was that if--I stayed--

Cooper How many times did you get in and out of it?

Conrad Twice. The big problem was having you unhitch the straps on my suit.

Cooper That's right. With the cables to go over the harness.

Conrad The harness--the easiest thing was getting in the legs. That was no problem at all.

Cooper Yeah.

Conrad Where I needed help was getting over my shoulder and getting the straps on the suit hitched back up again, which is a two man operation.

Cooper Well, my point is that for normal wearing around the pad area or wearing around when your suited and everything, you'd be much more comfortable if you could have those straps loose where they're not gouging you in the legs.

Conrad Yes, well-- Oh, I agree.

Cooper Or where you had adjustments on them ....

Conrad ... adjustments see--

Cooper Okay, well.

Conrad Where you could make the legstraps loose but you'd never disconnect them so you don't have free floating straps around there. It was no big problem ....

Cooper My suggestion would be to have them exactly like you did in a parachute harness. You have the leg adjust-

ment and on that same fitting you have the little snap where you can unsnap in the places you want to.

Conrad Oh yes, you dan do it either way. Sure.

Cooper You could either loosen them or--I just think we've gone to such complex tailoring devices in order to provide some company with a great elaborate program of providing expensive harnesses that they ... I just personally don't think they're worth a darn for what they're intended for. I don't think you gain that much. I think you loose a lot of it.

Conrad We'd have been better off if we'd had a place to stow that harness.

Cooper The life vest. Now I disagree with everybody that's ever said that those aren't in the way. We wore them all the time mainly because we didn't have a darn place to store them and they're a pain in the neck to get on and off but they are really in the way. They're in the way of everything you do. They bump into your arms. They're there to cut down visibility on your chest and they're just a nuisance.

Conrad Yeah, we didn't have a place to store them.

Cooper We didn't have anywhere to store them or we'd have taken them off and left them off. I am here to say that I

think they're really bad where they are.

Conrad After the big sweat was over and we got a GO and we were relatively sure we were going to stay there for awhile unless we, you know, had some other emergency come up, I would have preferred to take off the harness and the life jacket and stow it somewhere if we'd have had a place to stow it.

Cooper Right.

Conrad But the other thing is that maybe that's just my personal feeling. I'm extremely meticulous and we kept that spacecraft as empty as possible. Everything had it's place and it stayed in it's place.

Cooper And that harness and the vest--are pretty big, bulky items -

Conrad And I wasn't going to have it rattling around down there on the floor,loose.

Cooper Okay, on the drogue pins. By golly, I thought those new little things on the drogue pins made them very easy to get in and out. There wasn't a bit of problem with those.

Conrad I popped the drogue pins in and out on mine.

Cooper I put mine in or out once just to ....

Conrad I think Gordo put his own in and out once to see if he

could do it and he could. That worked real well.

Cooper Okay. Fuel Cell O_2 and Fuel Cell Hydrogen Quantity Read. Yes, we read them at least a million times. Fuel Cell Power Readings. Yes, everything checked out fine on those. Bermuda 2-1 update: fine. Orbital Flight.

FCSD Rep You'd better get out your flight plan on this because this is the original stuff I was telling you about.

Conrad Well, that's all right. This probably will go fairly....

FCSD Rep All three, if you go the way you did it.

4.0 Orbital Flight

Cooper Okay, on 4.0 Orbital Flight. Platform Alinement.

Conrad There's our first problem.

Cooper There's our first problem. Our platform mode did not work and I don't know what's wrong with it. but the darn thing does not zero out the alinement on the spacecraft. It allows a good size yaw attitude to sit in there and won't zero it out and it is extremely sloppy in pitch. The whole thing, I think there was something wrong with the whole thing because it doesn't work at all like the ones in the simulator, and the whole thing plus or minus a half a degree should be a very, very tight control system and this was lucky to be plus or minus ten degrees in any axis and I think there's something really wrong with it. I personally think that

something was wired up wrong or something in it because it was not working right.

Conrad We didn't really get a chance to evaluate it too well because we had trouble with it so we stopped using it and by the time we'd been able to do anything with it we had other problems, fuel problems and so forth. So we never did get back to using it again.

Cooper Well, we had other control system problems which were overpowering, platform problem wise, but we did try one burn on the platform and it was a terrible mistake. The darn thing did not have the accuracy to really hold it and we got one foot per second in and out of plane there.

Conrad Yeah. That was in those coeliptic.

Cooper In one of those, that coeliptic burns and we made our other burns then on Rate Command and man, that Rate Command system is just beautiful. It holds that spacecraft so tight that it can't vary.

Conrad Yeah. We had a beautiful control system, I thought. When Gordo made any of the burns on the Rate Command or anything like that it really responded -- well.

Cooper Rate Command has tremendous torqueing. Boy, it's strong and it's instantaneous and you can just stop it right on the money. Really good.

FCSD Rep Okay, on this platform alinement thing. You went to SEF and caged and SEF and Platform Control Mode.

Cooper We pitched down to visual when we went to CAGE and then went to SEF and we went to Platform mode and after fiddling around with it awhile we decided the Platform mode wouldn't work so I went to Pulse and then I, just using my needles, Platform needles then, I just pulsed the errors out until we torqued around and got the ... got it ... on a fine line.

Conrad Okay, Now, there's no doubt in my mind that the Primary Scanners, there's no doubt in my mind now, but we lost on Primary Scanners. We started to aline the primary Scanners and I don't think we ever got to platform aline correctly because the primary scanners were not working correctly.

Cooper Now the primary scanners. The funny part of it is the Primary Scanner was working in such a manner - working just enough, that it checked right because when we checked out the alinement of it and the tolerances on it it was working fine, but there was something in it on one of the tests that we did later showed that it was actually driving, tending to drive the spacecraft down.

Conrad Continuing to torque you down to about fifteen degrees nose-down.

Cooper Or more.

Conrad In other words, it continued to try to aline the platform at about fifteen degrees. It tried to put the nose on the horizon is what it did.

FCSD Rep It tried to aline the platform up at fifteen degrees nose down?

Cooper Or more. I figured it was about somewhere around-- Well, one time it alined us at about 40 degrees nose down and it still was indicating in scanner limits.

Conrad The scanner got worse as the flight went on, but I don't think it ever worked correctly.

Cooper No. I don't think it did, now I look back.

Conrad That's the thing right there and I think that this-- I'd like to know what they decided from tracking the REP on how we put the REP out because we put the REP out in the proper position, but I don't think the platform was alined correctly. We had trouble with that scanner in the sunlight on the horizon and this was right when we were using it to aline - just before we put the REP out.

Cooper Just as we were using it to aline and put the REP out, the Scanner began to skew all the platform needles off and it skewed off and, --went to ORBIT RATE.

Conrad Now wait til we get the onboard tapes because the tape recorder was working and this all is on the onboard tape; the conversation that Gordo and I had about that. So we weren't really sure it was working right but it wasn't that far off that we were going in the dark--

Cooper Approximately 30 seconds before we had to pitch around or had to yaw around to eject the REP, I had to go back to CAGE and try getting a real rapid Platform aline in there, SEF and PULSE and I had the needles zeroed and we may not have been so far off but you don't know. That isn't enough time to really get it alined. In other words. I had about the time we did it and got there we probably had maybe, 30 seconds to Platform aline. That's about all we had.

Conrad Well, we were just hoping that if it had been pulled off only in pitch why, you know, we'd get it right--we'd pull the pitch right back in again.

Cooper But the scanner was acting up very badly by that time.

FCSD Rep How long did you aline the Platform initially?

Cooper Initially, we alined the platform for about 15 to 20 minutes and it seemed to aline allright although at that time Pete and I had a discussion right then that we seemed to be alining nose down.

Conrad Now, you see. Here's something that I've never heard from the other guys.

Cooper Now there's another thing. See, we never had a simulator to show us. Never once did we have any darn thing to show us what out the window should look like.

Conrad And when the Platform is alined and you're zero-zero-zero, boy, oh boy! That's a, just -- It's a very peculiar looking situation and it's not what I expected to see at all.

Cooper No, it isn't me either.

Conrad And I've never heard either Gus of John or Jim and Ed say "Put a little gouge out" Now I've got a gouge that I can draw for you where I'm sure that I can put the Platform in roll and pitch within a degree in roll and pitch of where it should be out the window on the horizon and it's by using the corner of the window and the RCS thrusters on the front: the front RCS yaw thruster in the lower corner of the window and you can put the Platform-- you can put the spacecraft zero-zero and roll and pitch just, well, like that. We didn't know that before we went.

Cooper This is one of my strongest recommendations if we aren't going to have any kind of a visual out the window display at least we ought to get some of the great planners to

draw up on a piece of paper what the window, what the horizon should look like through the window which I'd requested several times and never got -- to show the guy what these various things should look like out the window. We spent the whole darn eight days trying to figure out what some of these angles should look like and I'm not sure we were very clear on it to the day we re-entered.

Conrad Yeah.

Cooper Now that's ridiculous! And it's because of this odd angle that you sit off in there. It completely fouls up everytning, as to getting these various angles: inverted and right side up and 90 degrees angles and all this.

Conrad I think we ought to--I'll tell you it's a good recommendation for the guys who are going to have the time to do this on GT-7 with that Hasselblad can take a pound or two of fuel and sit up there and photograph with the camera back inside the spacecraft so that you get the window perspective in this thing. Photograph zero-zero-zero, bank right 90, bank left 90, at different nose pitches above the horizon. Boy theres--you start moving that nose around and it's not like an airplane.

Really, we sat there and had hours worth of discussions in drifting flight when we'd be drifting through, you know, and we'd say, "Hey, doesn't that look like they're about 30 degrees nose up and roll right 60 degrees?" and then we'd try to find those lines and match them and see ... there's an awful lot of learning there. By golly, if we'd have a Platform Aline Gouge, a visual gouge idea, we'd have picked up this trouble right off the bat. We really didn't think the platform was alined right, but we really didn't have anything to tell us that it wasn't.

Cooper Now looking at it where we know now after we went to the other scanner finally and we got proper operation knowing what we learned during the flight it appears now like we were--the number one scanner was trying to aline us several degrees down over what it should.

Conrad Yeah.

FCSD Rep Did you ever go back to Primary after that?

Cooper Oh. We checked it a lot of times after that and tried it numerous times and it got worse and worse and worse and it finally was actually driving the spacecraft down to minus 90 degrees and still the scanner, that's the funny part of it, the scanner wouldn't go off until you were about 60 degrees below the horizon.

Conrad It seems to me we've got some data for them on Primary scanner over the states so they could have it on telemetry. They should be able to find out what happened on that.

Cooper Yes, something was really fouled up, I think. Insertion Check List--

Conrad We went through it by the numbers.

Cooper By the numbers, Thruster and Control Mode Check - we went through by the numbers. Everything was fine.

Conrad Well, we were a little bit late. We got a little bit behind and it was about the time when we were late performing the thruster control mode check because that was supposed to be done before you got to the Canaries and we did it after the Canaries.

Cooper That's right.

Conrad We were behind, but we started catching up.

Cooper Com Systems Check. We were right on the money, on time, on that.

FCSD Rep Everything checked out okay on that?

Cooper Yeah.

FCSD Rep Com System?

Conrad D-4, D-7, I did by checkoff list and checked out okay over Carnarvon.

Cooper 6-4 GO/NO GO, well, that was quite late.

Conrad No. We got a GO for 6-4 over Carnarvon. That's just to get past 2-1.

Cooper Okay, Yeak Okay, got the 6-4 GO/NO GO, that's right, D-4, D-7 GO/NO GO. Those were right on the money and everything was fine there. Third adjustment maneuver.

Conrad Was nominal

Cooper Was nominal and everything was fine there. Power down D-4, D-7 was nominal. 16mm, 35mm, D-6 equipment unstowed and mounted and there we begin to deviate a little because just prior to this time we began to get this rapid decrease in the -well- where was it there?

Conrad It was-let me go into the log-book here for one second because I got some.

FCSD Rep This Perigee adjust. Did you do that in Rate-is that the one you did in Rate Command? Or is that the one you tried in PLATFORM?

Cooper Did that in PLATFORM and it worked fine on that one. Did that one in PLATFORM and it worked great, but then on some of these other burns we did I tried it in PLATFORM and it really didn't work well at all. That's why I rather suspect the PLATFORM thing. There's something wrong with it. I think it was better at some times than others. It was allowing a lot of drift.

Conrad Okay, in the log book I have it at 50 minutes which is just prior to Carnarvon that I found the Fuel Cell O_2 and H_2 Heater Circuit Breaker OFF. Now that--I found it off because they told us to heat the Hydrogen not the Oxygen, but the Hydrogen finally drilled down to the 220 and they wanted us to use the heater and I turned the heater on and I noticed that I didn't get any ammeter rise and so I looked at the circuit breaker panel and the Circuit Breaker was OFF. So, now in retrospect seeing the O_2 ON which is on the same circuit breaker burned out, I'm sure that it blew when this thing burned out.

FCSD Rep We were at the power down on the D-4 and D-7.

Conrad Oh Yeah. Well, about that time I think we were getting back on the Flight Plan. We got the 16mm out. We got the 35mm out.

Cooper D-6 equipment was - - -

Conrad Well, it's really D-2, it's what it was and I had that work so I decided, "I'll put together in pieces at the blob and the camera put together separately and they had it all loaded with the right film and everything and had it on the floor, and we were ready to go."

FCSD Rep Were you pushed for time to do this?

Conrad We were right on the money. We finally caught up after Canaries and we were on the schedule at Carnarvon.

Cooper Yeah. We were in good shape at Carvarvon.

Cooper Radar test #6, at 01:30, that worked fine. We did bring it on. It worked. Observed the transients on R dot, range and range rate. 6-4 Preretro command load came out fine. Blood pressure on the Command Pilot there past Carnarvon, let's see. Now that was back over the Cape here, yeah.

Conrad No, you broke the O-ring didn't you? Right off the

bat we broke the O-ring.

Cooper That's right. That's right. That's the first one. We broke the O-ring and couldn't give them that blood pressure.

Conrad I think that was the one.

Cooper That's right. We finally gave that one up. The O-ring was broken on that one.

FCSD Rep Let's see. This first blood pressure that you got an hour...

Conrad They got that one and then when Gordo--

Cooper When I, When we transferred over to me and I plugged it in the ...O-ring broke and we didn't have time for that pass again.

Conrad We had a bunch more O-rings. I forget when we fixed it but we fixed it...

Cooper Fixed somewhere around there.

Conrad ...shortly thereafter.

Cooper M-1 experiment.

Conrad We turned it on on time.

Cooper Yeah. I got a lot of comments later on that on. That thing is so noisy.

Conrad Oh, you know, I found out what happened, you know. They went back and recomputed and they found out they had four days worth of air in the bottle--Ha Ha!

FCSD Rep Four days?

Conrad Yeah. It ran out.

Cooper But the thing. You can turn it off and it keeps running back there. And it goes SMACK-CHOO, SMACK-CHOO, SMACK-CHOO.

Conrad Yeah, it's pretty noisy.

Cooper And in a real quiet cockpit it really sounds loud.

FCSD Rep This radar test #6 here at 01:30-

Cooper Used to turn the radar on.

Conrad Used to turn it on.

FCSD REP Used to turn it to standby.

Cooper Turn it to standby and warm it up.

Conrad Used to observe the warmup transients.

FCSD REP And all this happened, right?

Conrad Yes, and it's on the voice tape. Like Gordo said, you know, what the radar needle did. What it does is it has sort of a cyclic thing when you put it in standby and it's ready to run why it sits there and the lock on

light blinks Green/OFF, Green/OFF.

Cooper Lock on light will blink on and it will come out R and R dot will go from peg to peg. And they'll settle out when it really is warmed up good and you've gotten past the transient periods and they'll all come back to zero.

Conrad I think what they're looking for are clues to tell you that the set is warming up correctly. Back in the early days of TACAN we had warmup problems.

FCSD REP In other words, this would be your first indication if something was wrong?

Cooper Purge Section. One and Two.

Conrad Well, we got our first load, this 6-4 load. The first load that came up over the DCS system and it came up right over the Cape.

Cooper Purge Section. One and Two. Got that?

Conrad Yes, no. Yes. That's when we were getting rushed. Let's go back to that. Let's stop right there. The REP was supposed to go out at 02:07 and I purged early and I always had been purging early because I purged it about 1+50 and then I went through the check off list and they were all checked off here. I powered up at 1+50, I purged the fuel cells and here I checked them off here. ... prop gauge experiments and the RAD 1 on and the cold

IR on and the power on the exmitter on and the recorder off and I went through these by the numbers. Computer, we went to Catch-Up. We had the hundred feet in the window. We were really getting ready to put the REP out and right then and there was when we came over the hill and we were beginning to get to the dark side you know, and the sun was getting low and that's when the scanner started going out.

Cooper That's when the scanner started dropping out.

Conrad And we started getting the scanner light and then now, you got to visualize there's part of the problem. We're coming into this "Fuzzy Zone"-horizon and that is the best way to describe it.

Cooper Yeah, you can't see anything.

Conrad And the spacecraft looks like you're pitched up tremendously when you're zero-zero-zero to begin with and we both had the impression that the scanner was pitching us up. Well, that may not have been true. It just may have been that that's the way the sky got to looking as we approached the dark side zero-zero-zero.

Cooper Actually, you have a transition point there where you cannot see the horizon and it doesn't look like either sky or earth or anything. It's a complete blank.

Conrad It's really a grey area.

FCSD REP Right at dusk.

Conrad Yeah.

Cooper Right at dusk or right at sunrise.

Conrad Yeah. Now the first time we went through there we didn't even see it. We were working. That was right after insertion. So, mind you, this is the second time we got to see it and I can't emphasize this point enough, even though we were on the flight plan and everything else, you got to let the guys learn what's going on up there. You haven't been up there before in that darn vehicle you've got to learn it. That's right where we started getting in trouble.

Cooper That's right. That's the exact point that we made.

Conrad I made it for six months now.

Cooper For many, many months we've made this over this flight plan, sticking this REP, this whole REP thing in that early in the Flight Plan before you really have a chance to get the systems ironed out and checked over and everything and if everything goes exactly right and nothing fails you can run through it time and time and time and time again and you'll make it and you'll make it on time.

Conrad Yeah.

Cooper But you add one little failure in there and you've had it.

Conrad. Yeah. That's where I made my first mistake. We got purged in an hour and 50 minutes and I was going by the check off list and right there we got in this discussion about what was happening to the platform and I missed the most important thing on the check off list. I forgot to blow the doors on the cold IR. It's just as simple as that. That's the whole G-- d------ Flight Plan been running for the D-4 cold IR, it's been our biggest constraint and a thing that I knew as well as my right arm but there was a glitch and the glitch got us off the scheduled activities and I missed it bigger than heck. I didn't blow the doors on the cold IR and it's all my fault and I accept the blame for it. We went through this quickie aline business and we got turned around and Gordo had it right on the money, we were right out of plane and we got the REP out 15 seconds late. It went out at 02+07+15 and we turned around, waited for one minute, got the radar on, locked on it and we were whistling away from it and I was back on the Flight Plan and happy as a clam when I suddenly

decided that something wasn't reading right and I realized that I hadn't blown the doors on the cold IR and I blew them and at that time the REP was at 2500 feet from us, which is the end of the experiment, but I think it was still reading--

Cooper But it was still reading on the, according to the gage.

Conrad Yeah. I think that cold IR read to a great, great thing. Now, the Radar gage, this is where--here comes the next mystery-the radar gage said the REP was leaving us at this point in time and that--

Cooper Five feet per second?

Conrad Yeah. I have 3 1/2 feet per second written down.

Cooper Oh, at that particular point. Oh, well it--when we first got our first measurement on it the range rate on my analog dial over there read exactly 5 feet per second that it was going away from us.

Conrad Yeah. Okay.

Cooper Right on the money.

Conrad To go back to the D-4 in time it was 02, it was 02+16+15 when I blew the doors, which was corresponding to 2500 feet and I ran that REP D-4 recorder until 02+37+12 and--okay, now. That darn REP! Gordo had the needles right on the REP and that REP was going straight out from us at 270 on the ball. It just went, I just

thought everything was going perfect. The REP was moving just exactly out of plane away from us and it was moving at about the right velocity and then the mystery came. It just kept on going.

Cooper Yeah.

Conrad It kept right on going straight out, and--

Cooper It wasn't slowing down very much.

Conrad And I got over here on the graph and I kept reading the mileage and we were up to about 7 feet a second. It was leaving us, and I realized, I began to think, well gee, this is- That's when I was really convinced that the platform wasn't alined and we must have kicked it out some screwy way. Then it started to drift behind us quite fast. It finally did peak out and it went around the corner at some phenomenal distance, like it was almost nine tenths of a mile away from us, but at that point it had started to drift aft quite rapidly and when we got to the nodal crossing time, it was behind us by a mile, according to the radar. Now this is all on radar. And now, mind you, it's nighttime and it was right there. We could see it plain as day.

Cooper Okay, let's see, we were at the--

Conrad Okay, that's when we got to this next screwy thing.

See, the REP went straight out and kept on going.

Cooper The REP goes straight out and then it just kept on going. It was slowing down very little and just kept on going and going and going and going.

Conrad And it never really stopped. What it did was it sorta, it sorta starting going off this way, you know, and it never got out to a node point where you had a definite stopping range and a start back in again. Well, the range rate never got below a foot per second.

Cooper The range rate never decreased. You never got a decrease in range rate, but it just kept-it started drifting slowly off the 270 line on back out, but it went straight out the 270 line to a--

Conrad For quite a while

Cooper What was the range? Do you remember what the range was when it still was out there?

Conrad It went straight like relative motion to us would have looked like it went out looking down a plan form, if we were here. It looked like it went out like this and it slowly started doing this.

Cooper Yeah.

Conrad And it never did have a stop to it. It finally crossed behind us back in here someplace.

Cooper We never got the point where it crossed behind us because somewhere when it was about the 210 point was when we were out of fuel, of fuel cell O_2.

Conrad Yeah, well, you see, we went by Carnarvon--

Cooper And this was coming down just BALOOM BALOOM BALOOM BALOOM BALOOM.

Conrad See, here we go. We went by Carnarvon. Here I was trying to figure out in here what was going on and what we were going to take out and everything and we went by Carnarvon and right here at Carnarvon and that's when Charlie ... called up and says check your O_2 heater switch to AUTO. Now I had seen it fall, had noticed that it had been falling and I had gone to the AUTO position when without even being told --

Cooper You had already gone to manual.

Conrad And then I was doing many other things and I decided it wasn't coming up and so I'd gone to manual and held it over there a couple times and sort of looked at it and --

Cooper That didn't work either.

Conrad I must have kidded myself into thinking that I was getting something out of it, and then I forgot it again and then--

Cooper But you did go back to the AUTO.

Conrad Yeah. I put it back in AUTO, you know, and then I called them, I think it was on the tape and I think I told them, I said, the switch is on AUTO. We're okay. Don't worry about it and then right after that we got up to this 240 or so in there and we realized that something was wrong and the heater was out and I guess we told them--We told them at Carnarvon that the heater was out.

Cooper Well, we checked at that time then on the ammeter on and off and on and off that on both manual and AUTO and it was obvious.

Conrad And that's when we--

Cooper And it was coming down so rapidly that it looked like very shortly thereafter we were going to have fuel cell stoppage.

Conrad We were getting below 200 and falling pretty fast and we had a big discussion between ourselves and we just made up our mind to forget the REP. We felt we were really in trouble.

Cooper So we elected at that point to start powering down because we knew that we were using fuel cells at a very high rate.

Conrad And we secured the Platform and Radar and everything else.

Cooper So we said okay and we're stopping it right here and of course about this time we were in the boondocks area away from everybody as always occurs.

Conrad We were between Carnarvon and Hawaii.

Cooper And--so we just started powering down everything and holding on.

Conrad So from there on we were off the Flight Plan.

Cooper From here on to the next twenty orbits the REP was right with us. Ha,Ha,Ha!

Conrad That's what I cam't figure out. How did it get 375 miles from us when it hung around for 5 orbits? That darned thing. Everytime we went on the night side-

Cooper It was so--

Conrad As a matter of fact, I didn't see it for a time or two and then all of a sudden, the nose of the spacecraft was lighting up!

Cooper We even saw it in the day side. It was so near we could even see it in the day side and at the transit areas when the light would be shining on it we'd be just going into the darkness we could look back and you could even see the dipole on it as it tumbled. The tumble rate was very, very slow.

Conrad And then you guys called up and told us it was 375 miles away.

Cooper That's impossible. That thing wasn't that far away. It hung right in there.

Cooper I think that's the whole things.

Cooper But I'll tell you there were two different night sides we went into. Several--

Conrad Two different night sides--well, I really--it wouldn't have surprised me if it had hit us.

Cooper Me either. It seemed to me like it was a lot closer.

Conrad That's what made me think that well, the platform was aligned and I don't know what exactly happened. I did notice that it sort of climbed on us. So then I had the feeling that maybe it was doing sort of a figure eight type thing. That maybe we had fired it off up or down a little bit you know. And it was in three dimensions; a little bit out of plane working it's way around us, backing up and going ahead and coming back around because the darn thing was always there. It was there until the darn lights burned out on it. Anytime we wanted to find it if you wanted to move the spacecraft around you could find it out there.

Cooper It was close enough so that almost any attitude you were in you could see it shining on the spacecraft. Even if it was clear back out here you could see the nose just lighting up from it.

Conrad So I know it couldn't have been too darn far away. I mean maybe up to five miles or something like that, but it didn't get that far away from us. I don't understand the 375. I was really surprised that those guys called up and said it was 375 miles away.

Cooper Yes. Well, I don't believe that figure.

Conrad It will be real interesting to see what they dig out from it. Well, all the radar and everything we had is on the tape, isn't it?

Cooper Well, that was our first big heart breaker.

Conrad We ought to be able to put that all together.

Cooper After all the work we did on the REP, then not to pull the rendezvous out, we sure--

Conrad Well, from there until we got the GO to 6-4 we just were along for the ride. We just stayed--

Cooper I knew that--I was just so sure of all the time we put in simulating that darn thing I just had a queasy, uneasy feeling that maybe we better put

in more time on other things.

That something was going to go wrong--

Conrad I felt every problem that we had I felt real good about the fact that we had either the smarts to know that it was straight forward-- It didn't take too long to figure out that that heater was on one line, both heaters, and that we'd had a single point failure. And as a matter-of-fact we took the schematics out.

Cooper And there's another argument for our having it, for when it occured there wasn't anybody around to ask advice.

Conrad It was very straight forward to throw the switches and look at the amp meter to see whether you were getting anything out. There was no doubt in my mind that it had burned out and the same darn thing with the thrusters. When we finally decided we had a problem with them we went through the circuit breakers just like we did in the trainer and it was obvious that number 7 was out and 8 went out and then the rest of them started getting sour. So, I think that all the training we had we were pretty well prepared.

Cooper I do, too. I'll tell you--the launch--we were perfectly normal and right on the money--

Conrad Yes, we were sitting there waiting to find out what they wanted us to do. I mean we knew we could go on the batteries long enough to get to a fairly decent re-entry place and we were taking bets with one another and we were kidding about McDivitt. There must have been real pandamonium at MCC. They were burning up the lines to everywhere. Because there really wasn't anything we could do after that but just sort of wait. We re-stowed everything and we were ready to go into 6-4 if they wanted us to. We were all prepared to go into 6-4. We didn't want to.

Cooper We really didn't think we'd make 18-1.

Conrad Gordo was the eternal optimist though. I'd say, "125 pounds" and he'd say, "Well, it hasn't really fallen anymore." Then it would fall about another 20 pounds and I'd say, "Well, that's 100 pounds now," and he'd say, "Well, that's really not much below what it was before."

I think we had a little more confidence than the guys on the ground, I really do. I remember old

Steiner saying don't worry about that liquid going through that heat exchanger. He said it will go through just fine. The one thing that I thought was that we might have dinged the tank with the REP but as long as the quantity stayed up there we were in pretty good shape, but I wasn't sure that we didn't just might have some sort of a hole back there and were just slowly leaking pressure even though the quantity--

Cooper That was one thing--we always worried about that REP with that big diapole hanging out. If it skewed up a little going out what would it wipe out going out. It just happened to be with a lot of that OAMS--fuel cell lines and all that type stuff back there and that was one thing that always kind of concerned us about ejecting the REP now and then.

So that was one thing we kept running over and wondering what it had wiped out.

Conrad Yes. That was the only thing that kept bothering me, but it held to 60 though and that was pretty good.

Cooper Okay. Let's see boresight on REP, nodal crossing. We didn't get the nodal crossing. I sure wish we

could have hung on long enough to find out where it crossed us behind there.

FCSD Rep Let's back up just a minute on your lock on.

Cooper Okay. Boy, it just clung right on to it and zap. We got the lock on and the darn range and range rate came right on there. It was moving right out at about 5 1/4 feet per second just throttling right down the old line.

Conrad Address 69 was reading just fine.

Cooper Everything was right on the money.

Conrad Address 58,59--

Cooper The range was moving right on out just like it should and we were sitting right there on our 270 point on the ball tracking right straight out for a long ways out. Then is when the variance came in, when it kept going out. It should have started slowing down on range rate. But, it seemed like it was slowing down awfully slow. It seems like the range rate kept on for quite a ways.

Conrad You know I had a 58, of -63.8, and a 59 of a 139.8 at .89 miles and we should have never gotten that far away from it ever--in the beginning.

Cooper See with it moving out at the R that we had, all the figures we had ever run on it--we had our own

little calculations right here--finally we were off our graph up there, weren't we?

Conrad Yes. Well, you've got to realize that the graph's based on out of plane and this was the hypotenuse to the thing, but even so--

Cooper But still you've got to--

Conrad It still went away more than it should have.

Cooper Because you cosine angles were fairly small in there.

Conrad It still went away more than it should have.

Cooper I don't quite understand it.

Conrad We'll know what the platform--I presume they can tell how well we had the platform aligned.

Cooper But there again, there's the first little horse shoe nail that throws the glitch in things. When that darn scanner screwed up right at the most crucial time. It probably had been screwing up all along, we just hadn't really caught it. It really threw the glitch in right there at a point when it really shouldn't have. We may have lucked out still, and gotten it out right on the money and it may not have been the problem. I don't know, but anyway with the best we had to work with we got it out the best we could and it looked like

it went out in good fashion. I think we still would have been all right if we had gone ahead and done the rendezvous with no problem even if we had gotten a little out of plane with it we could have handled this later on. But, there again it made it difficult for Pete because it got him completely off his schedule, too. It got him late blowing the doors. Well, we still were reasonably well on top of it. Let's see.

Conrad We can skip all this REP stuff. You got anything else you want to know about the radar?

FCSD Rep It would be best I think to go on through it and say what you did and didn't do so we can stay on this.

Conrad Yes, well--

FCSD Rep Use your flight plan.

Conrad Well, we got as far--let's see, it says when on bore-sight read and record address 58, 59, and 69 and this was just before 2:51 when we were supposed to have a reading to give back on the ground. This is the reading I got: 58 read -63.8, 59 read 139.8. The distance was-- address 69 was .89 miles and I got that at the time that it was supposed to

be gotten.

Cooper Why don't you bring the flight plan over here and let's start down it. We might as well skip what he has in the flight plan here because it varies so from there on.

Conrad From here on you can forget this flight plan.

Cooper That's right.

Conrad Right here.

Cooper Where's our little book of the flight plan?

Conrad I've got it right here.

Cooper Oh, okay.

Conrad Okay. All this time we sweated out getting home and that's when we wound up--here is where we started on this flight plan, at 1 day and 02 hours, so that's 12 hours after lift-off.

Cooper We finally got back on A flight plan and --

Conrad Yes, and ~~tha~~t's the first thing we started to do was to power back up.

FCSD Rep One day. That's 24 hours.

Conrad No. That one day remember we--

Cooper We started that one day--

Conrad We went CET to 2400 Zulu and then that became day 1, 00 hours and lift-off was 1400 Zulu.

Cooper From lift-off until 2400 hours the day of launch was elapsed time and starting at that time we started calling it day one and then GMT.

Conrad Okay. So, we went through a little deal here where we started to power up and they let us turn-- we'd been drifting hadn't we?

Cooper Yes. I'll say.

Conrad We turned up the AC, ACME inverter on and the ACME bias power on OAMS attitude on and we went to pulse and we were supposed to power back down again at 02 + 27 + 25. We were supposed to have this H_2 purge at 02 + 45 + 00. That was the first thing, they were just going to let us purge H_2 we didn't purge the oxygen. Everybody was worried about that. Then we were on the flight plan and they gave us an update time for our first medical pass and we stayed--I think we took these vision tests, didn't we?

Cooper Yes, we did.

Conrad We just stayed right on the flight plan, had the vision tests, and I have a comment in here that at 01 days 04 hours and 32 minutes we saw our first meteor re-enter.

Cooper Man, we saw a lot of those meteorites re-enter

below us. That kind of startles you when you realize they are entering below you. It means they've gone through you.

Conrad This is when the experimenters went out of their minds. They handed us this flight plan you wouldn't believe where they had 1, 2, 3,4,5,6,7,8,9,10,11, 12,13,14,15,16,17,18,19,20,21,22,23, no 22 experiments they gave us to do in a row and they involved everything in the spacecraft and we had gear all over. You wouldn't believe it. I never had so much junk--we went wild. That's when we called up and said, "Hey, gang let's be a little more reasonable."

Cooper The other problem was they didn't list them sequentially.

Conrad Yes, that's right.

Cooper They put them in there and we had to keep skipping around on them to get the sequential time on them and that was a mess.

Conrad Now, what we did is we copied down in this book and then we'd write it down at the proper time so that we had it sequentially in the flight plan.

Cooper It worked out very well.

Conrad You don't want to get into which experiments we got done and which ones we didn't or do you? Do you want to go through it that detailed?

FCSD Rep Well, there's an experiment section in there.

Cooper Well, let's cover all the experiments in the experiment section. We might just comment right now how that I think our book arrangement worked out extremely satisfactory and I don't know how we'd have ever kept up with where we were if we hadn't had these books to follow. We just passed these books back and forth and we managed to keep them stowed pretty neatly. I knew right where they were. Pete kept them stowed beside his left leg in the seat. They slid right down the seat.

Conrad Right here and Gordo kept them on his right and if he had them and I wanted one --

Cooper If he was asleep I would just reach over and slide them out and vice-versa. And then our Volkswagon pouches held the little ones real fine. These books were used a jillion man-hours--just back and forth. They really worked out well. They're easy to write in and we tried to keep meticulous logs on everything and I think we did reasonably

well.

Conrad Okay, now we also wrote in these little screwy ditties. This is where we kept the things if they wanted us to power-up something or pull one of their nutty tests that they dreamed up in the middle of the night. We'd write them down just in order in which they came.

Cooper Do we just want to go right on down thrcugh here?

FCSD Rep Okay. Why don't we go right on down and list what we did and then when we get in the experiment section we can go into detail.

Cooper Okay. Where did we leave off here now. At--okay, one day 4 hours and 40 minutes. Let's see we didn't do this--

Conrad No, we didn't do the cryogenic test. That's right.

Cooper Then at 1 day 5 hours we did the S-8, D-13, Command Pilot.

Conrad That's another thing. They had you doing these things while one guy was asleep and one guy was awake. You wake up and have a briefing period -- it's just a bunch of baloney. We were both awake and when we took a test why we took it together and got it out of the way.

Cooper We ate together and slept together and took the .... together. We'd been completely startled

with terrible pulse rates when we'd hear somebody calling from down in that deep barrel, Gemini 5, Gemini 5, Gemini 5. Ha,ha.

Lights on all over the place trying to find the radio switch. Ha-ha. Out of a deep sleep.

Cooper Okay. I think maybe if we'd just go down through here and hit these things that particularly--

Conrad Tell me where we are in time and then I'll look in here to see what notes there are in here.

Cooper Well, and then we left these pretty well as we went through the flight plan here and then we left those pretty well--

Conrad Well, these are all the next day so--

Cooper These things are all ready listed in there--I think were just mainly the things we wrote in here.

Conrad These S-6 passes --

Cooper S-6 weather pass at 1 day 6 hours and 10 minutes. 1 day 7 hours 48 minutes 26 seconds. Sequence 08, we did that. That was the hurricane too wasn't it? And then we had another sequence on that-- the next trip around at 9 hours 22 minutes 49 seconds. We looked at it again. Then at 9 hours 27 minutes 33 seconds we had a sequence 208 and that was--

Conrad Man, we've got logs for the logs.

Cooper I don't know but what we might be better on this just to go through our individual specialty logs and log where occured at what time, because that's the more accurate one of all--because this was kind of our running logs of what was going on--to warn us when things were coming up ahead. As far as going back into this and doing the whole thing that isn't as accurate as going into--there are so many specialty areas in here. We have those logged real accurately according to time. I think it might be better to go through and get all those and build a flight plan out of that rather than go through the flight plan because the flight plan had to be just completely--we didn't sleep when we were supposed to and we didn't eat when we were supposed to and--.

Conrad Well, let's go on through this thing, and now as far as the experiments go those guys have a complete log of what they sent up to us and that should jive with the complete log that we have of what we received and from that and what we logged and what

we did we can tell you at any point in time whether we got a certain experiment done or not. If they want to know if we got something done or not and if there's a reason why we didn't do it why we usually had that recorded somewhere. Either in here or in the flight plan.

Why don't we go through this one?

Cooper Okay.

Conrad When we get to a point of the experiment or something we can check in here.

Cooper We did the UHF test.

FCSD Rep Why don't you read off those days.

Cooper Okay. One day and 8 hours--let's see 1 day 10 hours 49 minutes. Sequence 03 UHF test 3.

Conrad Right.

Cooper We did that.

Conrad We had--were supposed to do an Apollo at 01 12 36 17. Now I don't think we got that one.

Cooper I think that was sequence 208. Why don't you check that one real quick--yes.

I think that was the one we couldn't get because--

Cooper We had weather over that one.

Conrad Covered by clouds.

Cooper Okay, we had UHF test number 3 at 10 hours 49 minutes.

FCSD Rep One day?

Cooper We've all ready mentioned that one. We did get that one. We have that one written up here actually it occurred around down here. Flight plan up-date. Yes, we had lots of those.

Conrad Now, here was the D-4, D-7.421.

Cooper D-4, D-7 421 occuring at 1 day 12 hours and 7 minutes.

Conrad I'll tell you whether we got it done or not. No.

Cooper We didn't do that one.

Conrad I don't know why we didn't do it. We were in drifting flight by then, I guess.

Cooper Then we have a note right here. The D-6 number 19 scrubbed for the State side pass. They scrubbed that one. There was a weather problem on that one.

Conrad Yes.

Cooper Yes.

Conrad Okay now this is an interesting thing at 01 days 14 hours, completely different than GT 4, we started getting these RCS heater lights. Those guys--the only time they got an RCS heater light was something like day 3. Ed said it was in ring A and he turned on the heater and he got

the light 2 or 3 times and he turned the heater off then it came on again. You know, for an hour's period of time and he never had the lights again. Now, this is another reason why I suspect this OAMS system--one of the biggest mistakes ever made--whoever recommended it on the ground to power down that OAMS heater to save electrical energy fouled our whole system because we started at this point time having RCS heater lights. I checked for 8 days throughout the flight and I could always get an RCS heater light. If I turned off that heater switch I'd have an RCS light come on every once in a while and so we left those RCS heaters on all the time.

Cooper From one day and 14 hours the RCS heater were on the whole flight.

Conrad You know they're auto. And the only heat when necessary, but every time we turned the heater off we wouldn't run for an hour or two that the light didn't come back on again and it would either be on ring A or ring B.

Cooper And the temperature that we'd get on the gage when those lights would come back on was something in the order of about 60 degrees wasn't it?

55 degrees.

Conrad Yes.

Cooper They ran when the heater was on--it kept them between 60 and 80. One time ring B got up to 80 degrees. But it ran between 60 and 80 degrees, that those heaters kept the RCS, A and B. But, any time if you turned that heater off it wasn't any time at all until the light came back on again so we just turned them on and left them on the whole flight.

And that RCS couldn't have worked better. It was the most beautiful system you ever saw.

Conrad Boy, it sure did. Now, here of course--

Cooper As you say, in contrast to what we had before.

Conrad Here's another thing when we got into these high tumbling rates that really kept the spacecraft cold.

Cooper Shew! The windows even froze over.

Conrad Yes, it was darn cold.

Cooper We were down to minimum flow. We had both suit flows off--completely off. We had the suit coolant completely down to the next to last notch and we left it cracked as we were afraid we would completely freeze up the whole coolant if we shut

it completely off and later they told us that we could go ahead and shut it completely off. And we were sitting in there just shivering and shaking and I was a lot colder than Pete. He was cold and I was <u>really</u> cold. I was really thinking seriously about--if we couldn't get that thing warmed up I was going to take my suit off and I did for a while in fact take my inlet and exhaust hoses off.

Conrad Yes, that was his answer to the problem. When he got too cold, just disconnect.

Conrad Just let it blow into the cabin.

Cooper But, it was so cold in there that the windows froze over and we were sitting there spinning.

Conrad It had a rapid freeze on them. I didn't see that except when we were doing the high tumbling and it got really cold in there.

Cooper You could see the frost build up on the outside all over the spacecraft. Outside up on the nose section around the thrusters it had frost all over down there. When you tumble the thing doesn't have enough time for the sunlight--when the sunlight hits on it -- I think to warm up that particular section. When we damped it immediately thereafter

the whole thing started to warm up. You could see the frost melt outside. Everything seemed to go up. The fuel temperatures would go up, and the whole ECS system would warm up, the cabin would warm up and everything. We were sitting there--

Conrad A slow drift or stabilized flight--

Cooper When we were sitting there really spinning up, things just got colder and colder and colder. Now by spinning up I'm talking about we got up once to 12 degrees per second. It wasn't any bother to us except visually. You just couldn't stand to look at it out the window. It just gave you such an awful looking picture. Like you were in an inverted--upside down--wrong side up--. So we finally put the polaroid filters up ... the holes.

Conrad We got completely in the dark there.

Cooper I didn't even want to look at what was going on. It was odd because before you could take a pencil and put it out here and it's the best attitude indicator you had. If there's any little rate going on at all the pencil would give it to you. You can sit and hold it right out in front of you and it's just like an artificial horizon. It's the most beautiful--or camera or whatever you have out there it will do

the same thing. You put something out in front of you and it would just disappear. Whew!

It wouldn't sit in front of you. It would move from one side to the other of the spacecraft due to the rates you would build up.

Conrad Yes, here's where we got into this business of the OAMS Heater-Off and ACME-Off and the C adapter to Command and the Scanners-Off and they wanted to update the computer. We brought the IGS and the computer on and then we powered down again and this is--

Cooper One day 14 hours where this started.

Conrad Yes, right in here. That was passing over Carnarvon.

Cooper And then is where we brought up the second fuel cell. We brought back on--

Conrad Got the pump back on the line and then we got ready for our first big day over the States.

Cooper Yes, that's a great day.

Conrad Boy, we were busy though. We learned a lot.

Cooper I tell you though, those passes over the states were really good.

Conrad The third day was our best day as far as being organized. They gave us about the proper amount of experiments and we were well organized.--

Cooper Yes, we had a great day. That third day was a goody. Man we had everything right on the button. We got good shots of it and everything just worked out right on the money. Okay, let's see. This is 15 hours 40 minutes, that's still with everything powered up.

Conrad Then we had this D-1 and D-4 and we got those. Those were photographs. We got the photographs of the moon and the IR measurements of the moon and with the IR film and I think they're probably pretty good. Of course the Air Force has that film.

Cooper We found that the IR and the retical and the radar and everything were pretty well right on the money. Everything seemed to be boresighted pretty well, and Pete could look through his questar lense at a star and be boresighted right in the middle of the darn camera. I'd have it right in the middle of the reticle.

Conrad Yes, I've got to eat crow on that. I was the guy that was complaining about did they really have this stuff boresighted. Everything was extremely well boresighted.

Cooper Yes, it sure was. Can't complain about it at all.

Conrad No, it worked very well.

Cooper Let's see we had an observation of the storm and some pictures there at 17 hours and 12 minutes still on day 1. Oh, we brought the radar to stand-by to warm things up there at 17 hours-- 16 hours --

Conrad Radar temperature went down to 19 degrees .

Cooper 16 hours and 50 minutes--it was the secondary coolant loop that got so cold. They wanted us to bring on some added heat source so we brought the radar on to stand-by for quite a period of time to warm things up, and let's see--

Conrad They wanted to warm the radar up, too. It got too cold.

Cooper Yes, that's right. What did we do in here.

Conrad That was S-8, D-13.

Cooper That was S-8, D-13, and that didn't work out very well. That was too early. That was the one that was so early in the morning.

Conrad It seems to me that's the first time we looked at it and we saw the smoke.

Cooper Oh yes.

Cooper Now, let's see was it the first one or the second that I saw and you didn't see.

Conrad I don't know. I never saw it.

FCSD Rep S-8, D-13. One day and 18 hours.

Cooper I saw it. That's right. We couldn't see it at all until we were almost over it and then I found the target.

Conrad We could see the smoke and we were looking at the smoke and looking at the smoke--

Cooper The sun angle was very low and it was very bad but just after we got right on top of it and going on over I located the targets and was trying to point them out to Pete. At least I sort of got a pattern on the ground and I think that's why I could find them. I recognized the pattern on the general area of the ground that I could find. They were in between two rivers and a big red mud hill. Okay, what did we get on that? That was next and I got on that one. Let's see that was three and four and 18 hours and one day 20 hours 4 minutes 43 seconds. We got that. And then S-8, D-13.

Conrad The same one.

Cooper The same one we were discussing there. Yes.

Cooper Okay, we moved to Med Data to Hawaii at 19 hours and 55 minutes which we did. I got there at 7 in the Caribbean at 20 hours and did the MSC-1 at 21 hours 52 minutes to 22 hours and 44 minutes.

Conrad Then we stayed on the flight plan there and at Hawaii had a critical tape dump at 1 day 23 hours. I congratulated Gordo for exceeding his original flight time at 2 days ... hours.

Cooper Just barely started.

Conrad Gee. Oh! Here's that "dinged by a micrometeorite." I haven't told anyone about this because I'm not really sure that was what happened, because it happened twice and it happened right in the same place. It might have been metal cooling, but right over my head something dinged the hatch. Just bigger than heck - dinged. You know, just like someone shot a B-B off of it.

Cooper Yes, I could hear. That's just exactly what it sounded like.

Conrad I was convinced that we had gotten dinged by a micrometeorite. So I put it on the voice tape and wrote it down here. Then a couple of hours later we got dinged just as loud just about in the same

place again, so that made me think, well, you know they aren't going to strike the same place twice so maybe it wasn't a micrometeorite after all. I really don't know what it was, but I think it's worth a look at the hatch. It could have just been that metal was cooling down or expanding or something, you know --

Cooper They were right directly overhead on the right hatch.

Conrad Yes. It really sounded like someone fired a pellet or a B-B, or a .22 off of a piece of metal.

Cooper We decided we wouldn't put this out over the radio or we would get everybody all shattered. Okay, well essentially that day 2 - that whole page from 2 hours to 4 hours - went right on flight plan schedule. We did the Vision Test there and we called down the scores from both that one and the day before.

Conrad Now we were on this split purge cycle.

Cooper Yes, now here is where they started making a mistake. Somebody didn't realize that I could not purge the fuel cells from my side. I can't get to those switches, and I had to wake Pete up

every time he was supposed to be asleep when the fuel cells were purged. Well, I could get to them, but I had to crawl right over in his lap to do it, so he was awake then. After that I learned to wake him up early and let him get awake before he purged them.

Conrad Scared the heck out of that guy at Carnarvon, too, I'll bet you -- We were going to purge the fuel cells for the first time and I was sound asleep. Gordo said, "Wake up, wake up, we've got to purge the fuel cells!" I reached over there and turned on everything and all the Delta-P lights came on.

Cooper He hadn't put the crossover --

Conrad The crossover valve on. I said, "The Delta-P lights are on!" The guy at Carnarvon said, "Stop purging! Stop purging!" He must have thought the cells were going to go right then and there so --

Cooper And then Pete woke up.

Conrad Then finally I woke up and got to thinking about what was going on there and found out that I'd fouled up, slightly.

Cooper All right, let's see. We deleted on day 2, 6 hours, and 35 minutes, we deleted that Philippines S-7 and they

were --

Cooper I wonder what the reason was for that. There was some interference with something. I couldn't get to that one. Oh, what the heck was it? There was something else going on they had us doing right then. Oh, somebody was asking me something. They were having a big discussion over cryo. That's right. We had a great big 2 days 6 hours-we had a big discussion over the net on something on these cryos and it occured right at the time when we were supposed to get this one on this pass.

Cooper Okay, at 2 days 7 hours and 45 minutes we did MSC-1 again, and in fact I think we did all the MSC-1's pretty much on schedule. At 2 days 9 hours and 15 minutes we were supposed to do an Apollo Landmark in Africa, and the one they called out for us to do in the Flight Plan, there just wasn't any description of it. It was very poorly described and we couldn't find where and what it was they wanted us to get. They never did call out a number on this nor did they have it listed here.

Conrad What was the time on that?

Cooper It was almost 02:09:20:00.

Conrad 02:09, huh?

Cooper Yes.

Conrad Gosh, that doesn't even show here. So, I guess they never did even call it up from the ground. You just saw it in the Flight Plan.

Cooper It was in the Flight Plan --

Conrad But they never called it out.

Cooper They never called it out.

Conrad I haven't got it written down, either.

Cooper Okay, on through the second day we did another UHF Test, another Medical Data, on 2 days 12 hours and 50 minutes.

Conrad That's when we first powered the platform back up. We were still building up.

Cooper Two days and 13 hours, we powered the platform back up and we did a UHF No. 1, we did a D-1 sequence 2, we did a D-1 sequence 3, we did a D-6 sequence 12; and these are all stateside passes. That was a busy time! We did a D-6 at day 2, 14 hours. We did a D-4/D-7 at 14:35.

Conrad What's this, now? I have the platform power up, a D-4, a UHF 2 --

Cooper Right.

Conrad -- an S-6 at 15:45 --

Cooper You're ahead of where I was.

Conrad Oh, I'm sorry. Okay, we'll back up. D-6 at 13:41:46. We got Tampico instead of Monterey because it was clouded in. Then we did the UHF No. 1, and we got this S-5/S-6 during our African pass-didn't we? And we got the D-4/D-7 over Kano. Wait a minute, I'm not sure we got that one. Let me look in the log here. 4:20, no clouds over Kano, so we didn't get it. It was supposed to be cloudy over Kano.

Cooper That's right. There were supposed to be clouds over Kano. It was supposed to be clouds we were getting pictures of, and there weren't any clouds.

Conrad Yes, it was clear. Then we had an S-1, which we did not do. We did the S-1 later. That's when we went to platform power up and the computer on, and then we started a D-6 at 15:16. After D-6 at 15:16 was a number 20, which, if I'm not mistaken, was supposed to be Waco; and we got Dallas instead because Waco was cloudy then. Yes, it was supposed to be James Connally and we took Dallas instead, because Waco was clobbered.

Cooper What's this I have here? That's your note there.

Conrad 21.1 feet per second Delta P.

Cooper Oh, that was our pre-burn stuff. At 2 days 17 hours 34 minutes and 31 seconds we had a maneuver load.

Conrad Well, I have the whole thing here. We powered up the platform on day 2 at 15:50 with the platform caged BEF, and at 16:15 we alined BEF with the rate gyros on. At 16:45:00 the computer went on and we addressed 25 90201, and apogee adjust maneuver was at 16:50:17. We translated forward to zero the IVI, so it was actually a retro burn. I mean we were BEF.

Cooper We were using the aft-firing thrusters.

Conrad Yes. We had a D-6 on the ship, and we didn't see it, at 2 days 16 hours 56 minutes and 49 seconds. We didn't see the ship. Then at 17:20 the second day we alined the platform SEF and we sat the computer up to address 25 00158. We made an SEF burn, which was a phase adjust maneuver, at 17: 34:58. Now, that one we did in the Platform Mode and it didn't burn for schmaltz.

Cooper The platform didn't hold it. It allowed us to get a little bit of left-right and up-down.

Conrad I don't believe that Platform Mode was holding the tolerances it was supposed to. It was drifting a full degree, and it was supposed to hold better than that.

Cooper It is supposed to hold plus or minus half a degree.

Conrad By drifting off in yaw a degree, it burned the whole time 1 degree off in yaw in the same direction. You see, that accounted for the sort of large out-of-plane number; it was like 0.8 foot per second that we got in to the out of plane. Okay, then we had a D-4/D-7 at 17:42:00, a 410 B and a 407 over Carnarvon; and it was not done.

Cooper That's right; we didn't have a reticle.

Conrad Because the reticle pooped out. We thought the reticle had burned out. It wasn't until later on after we were going to fix the reticle by putting the auxiliary light in there that Gordo found that there was a short in the cord when the cord was stretched, and that the short wasn't in the cord when the cord wasn't stretched, and that the sight was okay. That reminds me of another thing. Right after we got airborne I went to use the little auxiliary light down here. It was in the

clip so hard that when I pulled it out, I pulled it completely apart. I shattered it. I broke out my lens. Glass floating around and everything. Where did we stow that? I forgot. I gave it to you and you stowed it --

Cooper I put it in the garbage bag.

Conrad That's right; it's in the garbage bag, someplace. Well, they have gone through all that.

Cooper Incidentially, that one single-point cord that we have in there over on my side, if I had had something to cut it with, I should have cut it right in two so it wouldn't be used again. It's no good. It works fine as long as you don't put any tension on it. When you string it up to put it in the reticle, it shorts out.

Conrad Then we went through another maneuver preparation at 17:50:00 on the second day. We alined the platform SEF and we sat up an out-of-plane maneuver and address 27 00150, 15 feet per second out of plane burn, and 90 degrees yaw left. At 02 days 18 hours 06 minutes 50 seconds we made that out-of-plane burn.

Cooper We did that in Rate Command and right on the money.

Conrad — Yes, we did that in Rate Command right on the money. Then we had an S-8/D-13 and we documented those things; Gordo saw part of it and I didn't. We never did really get a good score. Then at 18:50 again we alined the platform SEF and set the computer up to 25 00164 and burned this reverse coelliptic maneuver at 19:04:18, and that was a good burn too. MCC had put in their Agena computer an Agena ephemeris, and they ran a rendezvous solution on a fake Agena. They had us make the actual burns, and then they computed how close we would have wound up. I was told over the radio that we got within 0.2 mile of altitude and 0.3 mile horizontal distance from where we should have actually been. That was well within the tolerances, so they were apparently fairly pleased with the burns. Then we had S-7 at 2 days 21 hours 33 minutes 02 seconds, and Gordo shot most of those. They always happened on your watch.

Cooper — Yes.

Cooper — Then we did 2 days 21 hours and 50 minutes. We had Apollo Landmark south --

Conrad — That's when I woke up and you had that Lake ... I

got the S-7 again, or you got it, at 3 days 06 hours and 32 minutes. We deleted an S-7 at 3 days 05 hours for some reason. I just have "delete" in here.

Cooper What was that? An S-7?

Conrad Yes.

Cooper Yes. I don't know; they just told us to delete that one at 3 days 05 hours. Let's see; we deleted a Cabin Lighting Survey because Pete was asleep. That was one time when you were asleep and I didn't want to disturb you. You hadn't had any sleep in awhile.

Conrad You have the note down here that at 3 days 6 hours and 33 minutes you found the OAMS Control Propellant circuit breaker open and OAMS Control Regulator No. 1 circuit breaker open; and you don't know when they were opened, and I don't know when they opened, but we know what did it. We had been parking the water gun up there like you are supposed to be able to do and then pulling it off. You tend to pull down this way, which would cock the gun barrel up into the circuit breaker panel; and I think I probably knocked them off, but when

I'm not sure. So, from that point in time on we never used the hook-up that you can hock it up on the --

Cooper We also found that little-hook up was peeling gray paint off of those bars and it was floating all over the cabin.

Conrad That's right. It kept knocking the gray paint off the guards and it kept floating around the cabin. So from then on we always put the water gun in the gun holster down there where it belongs. As a matter of fact I think it was easier to get it in and out of the plastic thing that holds it on the circuit breaker guards - holds it on there so tightly that it is a big swivet everytime you pull it off.

Cooper Okay. At day 3, 6 hours 32 minutes 46 seconds we did an S-7 Experiment that aircraft support on it. This was over the Philippines.

Conrad We got four pictures.

Cooper Right.

Conrad We did an MSC-1 at 07:40. We had a medical data pass in there at 04:53.

Cooper Right.

Conrad Then I have Platform to ORB Rate, Prelaunch, and horizon scan for some reason. Questar 01, 90 degrees left.

Cooper We alined SEF at 13:10.

Conrad Oh, that was these platform tests 1 and 2 that they wanted us to do.

Cooper That's right. We were getting ready for another stateside pass, too. We installed the photometer, we did an S-8/D-13 pass at day 3, 13 hours 32 minutes at Laredo.

Conrad Oh, let me make a comment right now on S-8/D-13. We were supposed to make a measurement, a window survey, of the window before day one and the last day. Okay, the window scan was done on 1 day 18 hours 26 minutes 00 seconds. That was the first window scan. A second window scan was never done because the last 3 days of the flight we were in drifting flight. This required a 30-degree sun angle on the window, and we never did have a control system back until we were on the RCS system. We weren't about to do any experiments on RCS fuel. That was right before retro. The second window scan, the one at the end of the flight, wasn't done. But

I will make the comment that I don't think the window changed, just from my looking at it.

Cooper No, I don't think it did, either, I think it was just as bad at first, as it was at last.

Conrad That's right.

Cooper And it was pretty bad.

Conrad So, I don't think they lost anything there on that data. We just couldn't get that one.

Cooper Okay. Let's see. We had a medical pass at day 3, 13 hours 50 minutes - 13 hours 47 minutes, actually. Alined the platform --

Conrad We went through a really big day. This was day 3 and this was the day we were really organized. The experimenters sent us up about the right number of experiments. They gave us enough time between experiments, and they planned them well enough so that we didn't have any trouble changing the gear around or anything, and we had a big day that day.

Cooper This was a great day.

Conrad We had enough time to do it all and we felt good about it. We felt that it was the best day we flew.

Cooper Let's see. Day 3, 14 hours and 18 minutes, we did that Zodiacal Light.

Conrad That's right. Gordo really had it on there. I think he got some good dope out of that Zodiacal Light. The pictures should be good. Gordo held it right on the money.

Cooper Let's see; and then we did D-6.

Conrad On the D-6 134, we looked for the ship again but didn't see it that day, and that was one thing we didn't get.

Cooper I have here now a D-6. We did it. This is El Centro. No, no.

Conrad 021 is Dallas, I think, or something like that.

Cooper That's right. And then day 3, 15 hours 8 minutes.

Cooper — We had a full day this day. Let's see--at 3 hours--day 3, 15 hours, 13 minutes we had D-6 134.

Conrad — When was this?

Cooper — 3:05:13:51

Conrad — Yes. That was a 134--that was the ship and we didn't see it.

Cooper — Yes--that was the weather.

Conrad — Yes--I have "no joy for sunlight here." OK then we had a D-4 at 15:59.

Cooper — Right

Conrad — 409 and 410b and we got them both done.

Cooper — We got both of those.

Conrad — We had a platform aline at 16:15:00.

Cooper — And a medical pass - right - platform aline.

Conrad — What was that--the computer was off by 240 miles?

FCSD rep — Yes. Their computations were calling for 240 short based on what was put into it.

Conrad — That's right--that's just what happened and we were trying to fly short.

FCSD Rep Yes.

Conrad Well, do you feel better?

Cooper No--

Cooper At 16 hours and 24 minutes we had a medical pass. At 16 hours and 15 minutes we alined SEF, powered up the radar, rate gyros, etc. At 16 hours and 37 minutes we had a D-4 pass 423a.

Conrad That was the first missile.

Cooper And we saw it.

Conrad Saw it come up thru the clouds--or right at the edge of the clouds.

FCSD rep. Which one was this--out of here--

Conrad No--we didn't get any missiles out of here. It was out of Vandenburg. It was the Minuteman out of Vandenburg.

FCSD rep. You got it as soon as you came out of the clouds?

Cooper Yes.

Conrad Yeah--just as plain as day.

Cooper Right on it. Should have gotten some good readings on that. We powered up the computer then at day 3, 16 hours

and 45 minutes and radar was on and radar off, on--we had that radar test right in there that they wanted to do.

Conrad — Did we get those pictures of Venus and Fomalhaut. This platform 1 and 2 business?

Cooper — I thought we did.

Conrad — I didn't have a done log on that and I don't think I wrote that down anywhere whether we--

Cooper — I don't remember whether we ever got Venus or not. OK, let's see---the tape recorder was apparently still working there because you changed the tape there. That day at 17 hours--yeah--here we go.

Conrad — Wait a minute--here, I got it down here. Platform test 1, magazine 9, picture 23, 1/30th of a second- no - something Questar.

Cooper — Didn't get Venus--

Conrad — Platform test 02, magazine 9, picture 22, 1/30th of a second--oh, no filter--I'm sorry. Fomalhaut--we got Fomalhaut but

we didn't get Venus. We never found it. That's right.

Cooper That's right. We never even found Venus on that night side. Platform test 2--

Conrad And I got a remark here to find out that on day 6 at 01 hours, 02 minutes and 15 seconds where in the heck were we because there were great fires on the ground?

Cooper Yeah.

Conrad OK--so I did write it down--all right--SA-D-13, day 3, 18:16:14--and I had some comments about that here some place. 16:14 - We scored a 4 and a 1--and the 4 was in the upper--the 1 was in the upper left hand box and the 4 was in the second box in the second row.

Cooper Right. OK about this period of time--let's see we had an S-7--Oh, first before this--then we had run some more tests on our primary scanner and found out that it was completely inoperative and--

Conrad Yeah.

Cooper Just kept getting worse, worse, worse--and so--Pete has a note here--tell Houston about primary scanner--which we did shortly thereafter at 3 hours, 18 minutes, 3 days, 18 hours and 16 minutes we did an S-7, and then at 3 days, 18 hours and 25 minutes we purged, powered down, computer off, platform off, reticle off, rate gyros off, etc., etc.

Conrad Yeah. Then you have a--you've got an S-7 done at 03:21:20:08.

Cooper Right.

Conrad You had an Apollo landmark at 03:21:38:02 a 213 and I think that--we got Lake De Poo Poo or whatever it was, when we got that done.

Cooper We got that one.

Conrad There was a D-4 D-7 at 03:22:48:17 a 425a--I don't know what that was but--

Cooper Well, we also got in addition just before that at day 3, 22 hours and 15 minutes we got an S-6 magazine 4, exposure 12,

cyclone off Japan which has been added into there. And then you start on that HF test number 1 starting at 22 hours, 55 minutes.

Conrad — Oh, yeah, 425a was Hawaii, Maui.

Cooper — Oh, yeah, you got that one.

Conrad — Maunakea was the volcano--it's not active--but anyhow--

Cooper — Wait a minute--oh--213 is what--

Conrad — Huh? That's Apollo landmark--this was the D-4 D-7--let's see the Apollo landmarks--let me look there and see if we got 213 on it.

Cooper — All right, then that was at 22:48 - the D-4 D-7 was at 3 days, 22 hours, 48 minutes, and 17 seconds was the 425a--and 416.

Conrad — You got the Apollo landmark at 03:21:38: 02:213, magazine 4, frame 10, 1 - 2 pictures you took.

Cooper — Yes.

Conrad — Camera 11.

Cooper — Then--day 4 start at day 4, 00 hours,

25 minutes, cabin lighting. 19 minutes was the medical data, at 40 let's see-- 40 minutes there was the D-2 series 1, 4, 5--sequence 1, 4, 5.

Cooper Mode 414 I have here--What was that?

Conrad 145 was a military, U. S.

Cooper Yeah. What's this Mode 414--

Conrad That was if we saw it we were to be in Mode 414 on the IR.

Cooper Oh, OK. Then we had a D-6, mode 01 at 44:10, day 4, 44 minutes and 10 seconds.

Conrad On day 4?

Cooper Yes.

Conrad I don't have anything down here for that.

Cooper 04:00

Conrad Mode 01--that's--I think that's -- I may have the numbers wrong.

Cooper OK--at day 4, two hours, 20 minutes - vision tests, both of us.

Conrad Had that HF test in there someplace.

Cooper Yeah, I've already called that out. Medical data pass on me over CSQ at 03:11:00. We had an S-7, day 4, 03 hours,

20 minutes and 25 seconds, we got an S-7, sequence 01 and let's see--and thru this period was where we both completely ran out of steam--here on--we were trying to get you to sleep so I deleted all of these tests right in thru here to let Pete sleep. On day 4, starting at 3 hours and 45 minutes on--

Conrad Deleted the HF tests here--

Cooper Kept adding these tests in here that were--just weren't going to get him any sleep at all.

Conrad This was this 145 mode this was at D-6, D-4, D-7 and D-2. It was the 145 mode for the 01 and 414.

Cooper That's right. At day 4, 48 hours--

Conrad Yeah, here I have this thing--4th day, U. S. passes--we started at 11:00 o'clock.

Cooper What's this 04, 4 hours, 48 minutes and 58 seconds there was a D-2 that we had no success on.

Conrad Now comment on that. To do any of those things you have to have the platform on.

FCSD rep. Then the platform wasn't on?

Conrad Was not on.

Cooper That's right--see you got to be able to have an accurate means of pointing of having yaw and--

Conrad They said pitch up 83 degrees, yaw 45 degrees left--out of that window. You don't have any idea in the world. I mean, we didn't even have rate gyros powered up. You have no idea in the world where you are pointing, just--

Cooper You are wasting your time trying to do this kind of job without a platform.

FCSD rep. What is this a shot of--what is this target?

Conrad Well, for any pointing requirements, especially ones in the sky--

Cooper Where they are going at different angles, see.

Conrad You have to have a platform.

Cooper Then along at day 4, 5 hours and 40 minutes, Buzz's experiment was placed in there on a switch--

Conrad Yeah.

Cooper That was the straw that broke the camel's back--we didn't do.

Cooper Did MSC-1, day 4, 5 hours and something to 6 hours and something. Let's see--then on down to day 4, 11 hours and 5 minutes

Conrad Powered up.

Cooper Then it's powered up platform, had a medical data pass, 11 hours and 25 minutes aligned SEF--11 hours and 40, powered up the rate gyro and computer on--11:51 bio-med recorder number 1 off, number 2 on.

Conrad That was half way through the flight.

Cooper 11:55:55 we had a D-6, the recovery ship, and that was the one we saw.

Conrad No, we didn't get it. I got no joy on that one.

Cooper OK.

Conrad We got them the next time around I think.

Cooper 11:55:55, 134 sequence zero A.

Conrad Yeah, we got them the next rev.

Cooper OK.

Conrad OK--I've got the D-6 at 12:24:02 was done-

that was the sequence 091 or whatever it was.

Cooper Right.

Conrad The platform aligned SEF, for the command pilot we got--

Cooper Purged the fuel cells at day 4, 12 hours and 50 minutes.

Conrad Yeah, SA D-13 on Laredo at 13:23:39--what happened?

Cooper Neither one of us saw the target--on that one.

Conrad I'm not sure I've got anything written down. I don't. Why don't I? Huh. I don't know what happened. Then we had a D-6 089-what the heck was 089?

Cooper Day 4, 13:58:50, D-6 in East Africa--

Conrad Oh yeah, that was Blantyro Aerodrome and Malawi. I don't think we got that one.

Cooper Yes we did.

Conrad Did we?

Cooper Malawi airport--remember?

Conrad Maybe we did--I don't have a done written on it for some reason.

Cooper Yeah, I remember we had the picture of it you know and it was out there on that little point--or was that the one by Kano that we couldn't find because of the weather.

Conrad There's one in there where we did 089--let's see what it looked like.

Cooper Look up 089--that's the one where we had all the weather on it by Kano, wasn't it?

Conrad Yeah, well, we saw these lakes but--

Cooper We saw the lakes but that was in under a big deck of clouds.

Conrad Did we or didn't we get the aerodrome. I guess we didn't get the aerodrome.

Cooper No, we didn't get it. Because remember we saw the lake and saw the river come out and then there was this whole deck of clouds over there so we couldn't get that because of the cloud cover.

Conrad That's right.

Cooper We saw the general area--where it was at--but we couldn't get on it at all.

Let's see at 14:15, day 4, D-4, D-7, 410c.

Conrad D-4, D-7, 410c was--that's one of the ones where we were supposed to track a star or something--yeah, we were supposed to track Nunki and we never could find it because it was--

Cooper It was up in first, early--

Conrad It was up early--we had trouble with that. That's another thing I could have recommended those guys--we got enough to do in the spacecraft not to worry about setting up the star chart and figuring out from the--something you can't do from the star chart is figure out a pitch and yaw angle and the ground's got that information up the kazoo, so on any of these ones where they want you to photograph some stars or anything else-you've got to platform up again - the easiest thing to do is send up a pitch and yaw with it and that just takes all the work out of it

in the spacecraft. Gosh, we're messing around with the star charts--still don't tell you how much to pitch up or yaw around to find the darn thing.

Cooper — They tell you where it would be on yaw path.

Conrad — You just sort of got to figure it out- it's over to the left or the right and go over and look for it. Well, that's not the way to do it. Heck, we never navigated that way in the Navy. You go into star chart with local hour angle and it gives you the elevation and azimuth to the star, from North, and that's essentially what you need here. You need the elevation and azimuth angle off the orbital plane.

Cooper — OK, let's see--at day 4, 14:56:50 we had a D-4, D-7 White Sands Sled Run which was successful.

Conrad — And then we got the ship.

Cooper — An then we got the D-6 424a right after that. At 14:57:31 we got D-6 sequence 134.

Conrad — Which we did photograph the Lake Champlain.

FCSD rep. — Did you see this thing--how did you pick this thing up--did you use a telescope or-

Cooper — We saw him visually - found him visually and then

FCSD rep. — From the wake--

Cooper — Put the pipper on him and Pete took pictures with the big camera. Then we got a D-6 15:04:40 series 134. What was that?

Conrad — That's the ship.

Cooper — Well, what was the 424a?

Conrad — That was the White Sands Missile Run.

Cooper — Oh, OK. We got a D-4, D-7 at 15:19:00 that was the 419--

Conrad — The 419 was the ascension calibration. We did that darn thing again for them--remember that over Australia or something I don't know what the heck we did it for because I told them we got that thing once. Anyhow, then we did a platform aline.

Cooper — All right - 15 hours 40 minutes-

Conrad — Then D-4, D-7 was the second Minuteman which we saw but we didn't track.

Cooper — 16 hours 28 minutes, 423b - we did the HF tests 4 at 17 hours.

Conrad — Wait a minute- I got a - we had an S-7 at 16:37 and it was the thunderstorms in southern Florida. I think we got those.

Cooper — We got that one. All right -

Conrad — We had a D-6 at 16:51:25 which was an 065 -

Cooper — Right

Conrad — And if I'm not mistaken that was that Island off Brazil and we photographed the wrong island - then we found out our mistake in time and -

Cooper — Just as we were going over we shifted over to the other island -

Conrad — And we photographed the right island - it looked like there was only one island out there and we found out there were two islands out there so we did get the right pictures.

Cooper — There again, the maps we had just weren't

big enough in their overall look at things to give you a clue as to what -

Conrad — I'll show you this - This is the kind of thing that you just can't have-that was 065-now what you need to help you find an island is some clue as to where it is located in the world- well, that's what we had--

Cooper — Yeah, there was the island--

Conrad — Now it turns out that right up about here there's another island--laughter--and man we took all kinds of -- see fortunately it was far enough away - you -- look 15 seconds up there is 15 x 8 is 120 miles- and 120 miles is a lot of distance but you are covering that in 15 seconds - well fortunately this was about 15 or 20 seconds - we were pitched down and we were at least at the 90 and we got the second island a little bit past the nadir, because we already had been tracking this first island see and then here we came drifting along feeling how great we were

getting the picture but we really didn't think it quite looked like the right island but because we didn't see an air field on it - well here came the island with the air field - it was a good 200 miles down the pike but you need a little more -

Cooper — A little more help as to where it's at. Let's see 17 hours was HF test 4 - we did that.

Conrad — Yeah, we powered down.

Cooper — 17:40 - Medical data - we did that.

Conrad — Yeah, now here is a good time for a comment on this thing. Every time we went thru these state-side passes now a - to operate on a state-side passes - they start out two orbits before you hit the state-side passes-you started getting chatter--the first time you hit Carnavon and then well--no, I take that back - the first thing that happened is we come by that low sweep up thru Central America where we got Canaveral and Antigua and we get Houston

remote from there and it would be Dave Scott and Elliot and they would start giving us a little poop about what was going to go on that day see--and heck they'd tell us a little bit about the latest hydrogen calculations or something (laughter) and that was - we'd sort of get an idea of what was going on, then the next trip around is the first time you pick up Carnavon and then he'd start to give you an update and he'd get about half way through what you were going to do in those state-side passes and we'd pick up Dave Scott again at Canton and he'd finish it and then we'd come by that fringe pass by the states and that's when they changed the watch and we'd say hello to everybody that was going off and coming on and then we'd have all the stuff and the next trip around - that would start the three revs over the states see and then it was just go--you had gear all over the spacecraft - gee we had everything

we owned out and we'd be going through books and writing and flight plan and then we'd leave the states and it says pilot's nap period and Gordo was supposed to do something else and that was impossible - it would take two more revs to clean up the spacecraft before we ever got to do anything else so we never got on that part of the flight plan. This pilot nap period - that was a big joke -

Cooper Now pilot's eat period and nap period and all -

Conrad Always cleaning the spacecraft and we had to clean up the whole thing - it was a good time to do it -- we'd have meal garbage out and we'd have all the experiments out so we'd -- up to the states on that last one.

Cooper It was handier to eat together too - because you had to get the stuff out anyway--so it was handier for us just to eat together so we just always ate at the same time.

Conrad — And we would be in the process of cleaning up when we'd come by and we'd have that Guaymas pass where we'd come by and have California acq. and Guaymas acq. and we'd go right down the side of Mexico, the west side, and then cross the isthmus and go down Brazil and then from there on you - that was your last contact with the states and you'd stay out there with the CSQ RKV cycle through the rest of the night and that time we got all the way around there and picked up the CSQ the first time and we'd have Hawaii once more -

Cooper — Then we were already through my sleep period and that's supposed to be Pete's sleep period - that was the normal sleep period.

Conrad — We worked our tail off that whole time -

Cooper — That was the normal sleep period and we just barely have things all squared away so then we both powered down --

Conrad — Go thru this terrible 50 minutes with both of us like this - we'd uh-uh, oh, yeah - hi

there - laughter.

Cooper — Yeah, ok, everything's fine (snoring) (laughter).

Conrad — Talk about lonely--that's when it really got bad. You really knew you were out in the no place.

Cooper — We just discussed one thing while you were out, was this window situation. You couldn't even begin to see out of Pete's window when we launched. It was really terrible and it was in between those outside panes and glass. And my window between the outside sealed units and the inside unit of glass there was a bee -

Conrad — Oh, yeah, yeah, that stuff is on the inside of the outer pane. I don't know how that got there.

Cooper — And inside these two outside units on my side in between those and the inside pane of glass there was a little bee and a fly and a whole bunch of flecks of dirt and odds and ends in there. And my window wasn't as frosted over as his.

Over the period of time, they both got a certain amount of little frosty scum on the outside of them and when we fired the scanner covers there were about four or five little gray flecks of stuff and debris just flew everywhere right in that period of time and four or five little gray flecks came on the window.

Conrad — Heck, that's before launch isn't it? Oh, I didn't know that.

FCSD rep. — Did it ever clear up?

Cooper — No. I think it was just unforgiveable. I think if they can't do better on windows than that they ought to just quit trying. I could see maybe having some amount of debris and then when you use the thrusters the debris would all show up again. We were on--here we are up here--this med data. Day 4, 16 hours and that data - did.

Cooper — 16 hours 28 minutes - D-4, D-7, D-6, 423b.

Conrad — Yeah that was the second missile - which we didn't get any track on -- we saw -

Cooper HF test 4 then at 417. 4:17:40 med data was done. HF test 4 ended on - down there - OK, day 4, 19 hours 44 minutes was S-7 which was completed.

Conrad Yeah, both the S-7's were completed.

Cooper Then there's an S-7b, 21 hours, 9 minutes and 50 seconds storm Doreen - we completed. Time of closest approach was at 21:09:30. They had us tracking this storm - you see --

Conrad Oh, yeah.

Cooper We estimated the eye was approximately 250 miles left of course -

Conrad Have you got the orbits - yeah, here it is. This thing is the greatest thing in the whole world. It's the simplest - cheapest thing in the spacecraft and -

Cooper It is - it is great.

Conrad We would have been lost without this thing. This orbital update map. Boy, it really- well, the orbit was really good as far as -

Cooper You really don't know where you are at-

Conrad — But this is a good little map too. It really has the right things on it. There wasn't anytime we didn't look down and know exactly where we were. This thing is really great. Probably the cheapest thing in the spacecraft.

Cooper — That's one Jerry Jones made up. We tried out a long time ago and I said I liked it and I wanted to take one like that rather than this big elaborate one -

Conrad — Yeah, it really worked great.

Conrad — Yeah, I just saw all these map star updates we had here.

Cooper — Yeah. One thing they could do. They could put about 3 or 4 more orbits on it and not have to update it so often. Might be a little handier. Just a thought - but it's good the way it is. OK, let's see, we're on day 4, 22 hours and 20 minutes - we did a cabin lighting survey.

Conrad — We did the radar test 10. Cabin lighting S-7, MSC-1.

Cooper — And med data.

Conrad — Apollo landmark 207- that was at 07:14:25 must be day 5.

Cooper — No, not that far along - We did UHF 6 we did at 2 hours, day 5, 2 hours and something.

Conrad — You said you had an S-7 that was again during my sleep cycle and you said missed while discussing Cryos with CSQ.

Cooper — Right.

Conrad — And then you had an MSC 1 at 05:40 and you got that done.

Cooper — Now you're ahead of me--hold up just a minute. We're down here now - let's see - here's the S-7. 05:40 MSC-1 that was done.

Conrad — You got your Apollo landmark -

Cooper — Apollo landmark at sequence 207 at 7 hours and 14 minutes.

Conrad — What was 207?

Cooper — Lake Titicaca

Conrad — That was the Canaries -

Cooper — Oh, yeah, all right. Then we had SAD-13 - vision tests on both of us which we did together instead of separately. And then

at 5 day, 10 hours and 20 minutes we had Apollo No. 208, which we got. We had S-502 which we got. We had D-4, D-7, sequence 414 which we got and we had the platform tests which we did.

Conrad — Yeah then we got the radar test run -

Cooper — And Pete has a note here "Get serious," it really starts getting thick and heavy.--

Conrad — Well, I don't know--they were really getting wild -

Cooper — We had a platform aline - platform test, radar test, this is day 5, 11 hours and 35 minutes - We had D-6, D-4, D-7, platform aline, radar test -

Conrad — That's where they were off their rocker.

Cooper — But we got them. Those were all in the day 5, 11 to 12 hours -

Conrad — Listen, there's a lot of sloppy things in there - I mean we got things done but we missed little subtleties - like we were supposed to run the 16mm camera along with some part of the IR gear and I wouldn't get that on - and a bunch of

little things. Again, we were always man, they had stuff thrown at us as fast as you could say Jack Robinson.

Cooper Let's see--S-8, D-13 at Laredo--do you have one of those right in that period- day 5, 13 hours -

Conrad Day 5, 13 hours - no.

Cooper I don't have it either.

Conrad I have this all scratched out for some reason.

Cooper D-6 - This is where we really began to have trouble with something -- what was it we were really having trouble with?

Conrad The OAMS systems cut out.

Cooper That's right. The OAMS systems pooped out. Day 5, at about 11 hours when we were cranking up for this is when we found that our OAMS systems was really getting bad, and we already had discovered that we had one thruster out and a partial other one out but this is the time when we found out we had about 3 others that were just about out.

Conrad Yeah, I have a little note here - report

to flight voice tape out - number 7 yaw left thruster out and OAMS heater light turned back on again.

Conrad — And so we were supposed to ask 7 Keywest and D-8 S-13, SAD-13 about 6:22:50 -

Cooper — OK - From there on for a while things just got scrubbed in the flight plan on that day five, the latter part of the time on entries there.

Conrad — Yeah, that's when they got us into this minimum power down - voice control - 1 suit fan - 2 coolant pumps, 1 acq. aid, UHF receiver, DCS receiver, PCM -

Cooper — That's when they decided the hydrogen wasn't going to last at the present electrical rate.

Conrad — That's what I wrote down - Houston hot dope - drift for three days - ricky, ticky. (Laughter) Sorry -

Cooper — But at day 5, 19 hours and 25 minutes we did get a fix on Doreen - where she was there.

Conrad — Yeah, everything happened that day. That

was when the PCO2 started to read for some reason.

Cooper — PCO2 came off the scale and was reading way up there for a while. We broke out one of the CO_2 tapes, and it showed that we were still all right. We figured the gage was its usual reliability.

Conrad — Okay, now, I think this is good for the recorder right here. At that time, as of 5 days 21 hours 00 minutes they wanted to know what our experiment status was. So on the UHF, we had completed tests 1, 2, 3 and I said 6 just so that if they were still trying to keep that number under their lid. That's what it sounded like because they kept mentioning it. We'd done D-1, 1, 2, and 3 which had completed D-1. D-2 we had done nothing, because we didn't get the REP. D-6 we'd taken 72 pictures. D-4, D-7 we'd had completed 405, 408, 409, 410, 410a, 410b, 411, 414, 420, 422, 423a, 423b, 424a, 425a. We had 16 minutes and 8 seconds of recorder time left on.

Conrad On S-8, D-13 we completed all tests although we didn't see the targets several times. On S-1 we completed it. S-5 and S-6 we'd taken three magazines for a total of 210+ pictures. S-7 we had 23 pictures or 8 groups that they had wanted plus we had taken cal card picture. The M-1 broke at 4 days and some odd hours, and I don't know the exact time. M-3 didn't make any difference. MSC-1 we did on day one, three, and four. Apollo-we got Landmarks 207, 8, 12, and 13. We'd done 4 cabin lighting surveys. The humidity sensor we read at least once a day, and the 16mm film we had one and a quarter magazines shot up which is general stuff. That was what we had completed in 5 days. Then from there on, we went through this big drill of sending up of all kinds of experiments but don't expend any fuel on them. An so we were pretty well restricted to S-5, S-6, and S-7 type photographs which was about all we got.

Cooper Catch as catch can.

Conrad We marked down all this other stuff. We did catch a D-4/D-7 occasionally if it was the right sort of thing-if we were sort of pointed in the right

direction. Like I got a--in drifting flight I got 417 and 418 at 6 days 8 hours 41 minutes. I don't remember what that is.

Cooper From here on, we just--we drifted through this period of time and the only time we ever powered anything up was when the drift rates got up pretty high. We would power up, damp the rates, and power right back down, and hope we--and did manage to keep somewhat attitude so we could get occasionally some pictures. For instance on--we did continue doing MSC-1 experiments which incidentally--even in times of minimum power when they wanted us powered right down to our eyeballs they still left MSC-1 on. I don't know how much fuel it takes, but it always erks me if we had to have everything off why could they manage to leave that one on. Day 6, 8 hours, 41 minutes we got D-4/D-7 417, 418, and 414.

Conrad Yes, on that one day, Day 6, when they had the HF tests in Houston--broadcast HF--we had Houston on HF till 15 hours 59 minutes 00 seconds and this included the remoting through Ascension, and the remoting through Ascension was beautiful. That

was really good reception. And then they were playing 'Never on Sunday' and that faded out at 15 hours 08 minutes.

Cooper That was the best HF test we had.

Conrad Yes, and we started receiving the music again coming around the other side of the world at 15 hours 49 minutes. This must be 16:59. 14:59? 14:59, I got the wrong number in here I think. I'll just make a note to check it. No, this is 15:08, 15:49 which is about right half way around the world and this number may be wrong.

Cooper Is that day 6?

Conrad Yes, check it and see if we got a note in the Flight Plan. Day 6 at 1400, almost 1500. Then we did some of these radar tests and for the likes of me to understand do you know what was some of the discussion on why the radar didn't work after that. Gee, it locked up so beautifully the first day on the REP down there.

Cooper The one REP pass we had, man, things just worked like a charm.

Conrad And it just never did work after that. We always got a lock on.

Cooper And I read analog. My analog read beautiful, but he couldn't read out digital and that's impossible because the analog data comes from the digital data. I could even tell where it was. It was sitting out on Meritt Island, wasn't it? I'll bet--it was accurate enough--I'll bet you that you could almost tell what building it was in. It looked like it was right out here in the south part of the complex here.

Conrad Where were we receiving music from?

Cooper We got a little Chinese HF broadcast every now and then. Peoples program.

Conrad We went through these radar tests just drifting around out there.

Cooper Oh, yes, they were trying to jam our radios. Everytime we went over the China area.

Conrad I had the decided impression that they were trying to jam our UHF. So it was either that or--oh, yes, where was it where we heard the radar on the radio.

Cooper China.

Conrad No, we were along the fringes of Russia, but we went over China. We were over something like India.

Cooper We were coming right over the Tibet--the high Tibet

area there, and we were just on the south edge of China.

Conrad Have you ever taxied close by radar? You can hear it on radio, it goes "beep, beep, beep, beep," and you can even clock the antenna sweep, and you can get about three pulses...."Beep,beep,beep," and then, "beep, beep, beep", and you can see that old antenna down there on the ground going around and we could hear the UHF as big as heck and we were way up in the middle of no place, and I know darn well it must have been--Russian radar.

Cooper We were up on the high of southern China. High plains area.

Conrad Okay, then we ran another experiment summary, and this experiment summary was for the sixth day. And on the D-6 we did not see 135 which was the Laser. Laser out of White Sands. Never did see that darn Laser. And the D-4/D-7 we caught a 417, 418, and on S-6 we'd taken five more pictures. On S-5 we'd taken 43 more pictures and on S-7 we'd taken one more storm or two pictures. On S-8, D-13 I have no--we didn't get to mark the targets, but we may have gotten the 70mm pictures of them that

they wanted. I had to point--I may have all spacecraft in the picture. I don't know-we were just drifting by this one. And then at 11 hours 30 minutes on the sixth day, we went through this crank up this number 2 fuel cell again after it had been shut down for 20 hours. They wanted to bring it up by warming up the coolant loop so we went through this drill of shutting off the Primary Cooling Valve Circuit Breaker and opening the Rad Flow to BYPASS so that we could bypass the SECONDARY LOOP and let it warm up a bit. Then we went through the purge procedures and brought the fuel cell on the line. And it came on pretty good.

Conrad We never got any of the rest of the experiments on that day. They wanted general photos of the U. S. and so forth, D-6's and we just were never in position. We were always pointed straight up or something like that. Then we had another UHF test leaving the States and on the seventh day and we lost HF on the seventh day at 16 hours and 27 minutes and 00 seconds. I had the Squelch set on 4, and I brought the Squelch up higher and

and we got them back again and lost it 3 minutes later at 07 days 16 hours and 30 minutes. Then we did a MSC-1.

Cooper I have a note here 7 days and 20 minutes was that large storm where we located the depression on it. Take a look at it, and see just where it was, and weather breaking off from it.

Conrad And then when they came up with their next ground test which--

Cooper Had two S-7 experiments.

Conrad ...which I think we could have done without and that's when they had us warm up the solenoids for ten minutes. The thing that got to us was that we had turned-- They had us shut off the Propellant Valve and what we should have done was dumped the Propellant by rotating through all control positions on the handle, but what they had us do was go to the full yaw left position and dumped the whole load of manifold propellants out through the the mal-functioning left yaw thrusters and man did that couple up into a couple of beautiful rates, and we were doing it at night, and we didn't realize until it was too late and all of a sudden there were the

stars going by, and we were just going through the world every which way, and we were supposed to hold it that way for ten minutes and we were--okay, we were well aware....

Cooper Where were you? This day 7?

Conrad Yes, and I just got to this big set of procedures on that test and it didn't work.

Cooper I have a note here at Day 7, 3 hours and 19 minutes only 22 more revolutions to go. Same length as MA-9.

Conrad Okay, now, here are the comments of the degregation of the other thrusters. Now left roll only with the roll logic switch in pitch. We had no right yaw. Right yaw only with the roll logic switch in yaw position. No left roll. Then if you had the roll logic in yaw, pitch up and down were okay in yaw right gave right roll also. Pitch up, right roll, pitch down you also got a right roll. You've got to figure out which thrusters were weaker than the other ones.

Cooper Roll right gave yaw right.

Conrad Right, and then roll logic and pitch rolled right okay. Roll left okay. No left yaw. So and the

other thing is is when you hit the thrusters you can very definitely tell from the sound that some were putting out more than others.

Cooper I think that's what was giving us the yaw roll off was that in pairs of thruster of one would be strong maybe and one weak and would give you couplings.

Conrad That was exactly what was happening. They were cross coupling.

Cooper It was really messy.

Conrad And then I've got down here the roll. I have nothing else in the book until we start talking about retro here and the changes that we decided to go into 121-1 instead of 122. And there would be 27 minutes over Carnarvon instead of 36 and all the power up sequence. Now, I've got one comment. We came up over Carnarvon and when I had--when we left the Cape on the Rev going into retrofire a transmitted a valid load up to the spacecraft and I called McDivitt and I said, "I'm putting the Computer into Reentry," and we came up over Carnarvon and the guy says, "Stand by. I'm going to update you computer with a new load. Boom!"

And the computer was in reentry and I said, "Golly," and I switched that thing to prelaunch and he said the loads in and validated, and I didn't get a DCS light. And I'd gotten a DCS light everytime.

Cooper We never failed to get a DCS light.

Conrad And I was never really convinced even when we checked the two cores that the load was right that he put up there, but I guess it was. That's been checked out. We did have the right load in the computer.

Cooper That procedure is really poor, very, very poor.

Conrad I don't understand....

Cooper We had agreed and agreed and agreed that nobody would send a DCS load or anything without permission from you first--till they cleared with you first. And he just right out of the clear blue sky with 12 minutes--something like that to go to retro.

Conrad 27.

Cooper 27 was it? Well, anyway, it's getting down darn close. Here we were all lined--all set up to go and everything all squared away and what we thought was a real proper load out of the Cape. Had gone into reentry and here we were all set. Then here

this guy just says, "I'm sending a DCS update," and WHAM! here it comes. No warning. No nothing. Before you could even tell him to wait, the darn things in reentry.

Conrad He didn't check his ground information, because if he'd looked at his board, he would have seen that the computer was in reentry. He could have told us to put it in prelaunch. It all happened so fast. Boy, my heart really sank, because we had that thing--we were all set up. We were ready to go and everything and that was a big blitz. Now, after 121 orbits and we'd left the Cape after stateside track. Why, after 121 orbits did they have to update that thing between the Cape and Carnarvon? I mean they should have known where the heck we where. I just don't understand it.

Cooper I don't either and if they are going to play around with that, boy, my feelings right now on it is that that DCS circuit breaker ought to be off all the time. I felt that way before, and I decided well, those guys worked out so well that maybe it would work, but after that one time, that just convinced me that you ought to just

turn that darn thing off and leave the DCS circuit breaker off.

Conrad Okay, the next thing before retrofire.

Cooper I had one note here, just a second, at 7--Day 7, 22 hours, and 30 minutes. We were on that real black night side way down there somewhere on the South American area. Remember we saw those tremendous series of thunderstorms. Just fantastic, you could--

Conrad The brightest lightning I've ever seen anywhere. It lit up the inside of the spacecraft.

Cooper --see hundreds and hundreds and hundreds of miles almost as far as you could see in any direction out the windows you could see lightning just lighting up-just blossoming everywhere. There were hundreds of miles of thunderstorms of which you could probably see at one time-you could probably see 20 or 25 thunderstorms light up at the same time.

Conrad And I've got somewhere on the 16mm film. I opened the stops up, and I took pictures of the lightning. I don't know whether it came out.

Cooper They would just light the whole spacecraft up.

Boy, I've never seen such fantastic big areas covered by thunderstorms. Just, tremendous! And they were big, each individual CB looked like it was maybe 50 to 100 miles across and just whole columns of them stacked around. They must have really been....

Conrad Okay, about the only other thing that I can think of that we did in the test nature there--was wanted to and did fire the oams Squibb on the regulator, and you can't hear it. And every other Squibb--every other thing that we ever fired we could hear. But that one we couldn't hear.

Cooper That simulator was really good on that SEP OAMS, SEP ELECT, and SEP ADAPT. Simulator could be a lot louder on the SEP ADAPT. That thing really takes off.

Conrad How do you want to cover the reentry phase? Because that's about it. I've got one other comment, but this one is written after landing. It's the HF whip antenna didn't deploy.

Conrad Well, why don't we get ourselves down on the water? Stowage wise when we left the United States on the last California-Guaymas pass which occurred at-- it occurred around 7:18:40, something like that. We started our reentry stowage right then and there. Very early in the game, because we wanted to make sure that we had--that was almost 20 some hours to reentry.

Cooper First of all, at least once a day, we went through the entire cockpit and brought everything up to completely clean configuration. Everything stowed and we had about a 2 day basis. We planned what meals we were going to need for the next 2 days and we would get these meals out, get them stowed in an easy-to-get-to place--around the footwell areas-- generally in the footwells back in our feet area and would restack and restow garbage and try and get it completely caught up on a day-to-day basis, so that we didn't have a lot of garbage sitting around.

Conrad We always did it right after that California-Guaymas last pass over the States starting out into the boondock area and this conflicted with the Pilot's naptime. That was my scheduled naptime.

We never--we always ran late on that. I'd get the nap, but I'd get it much later and that would cut a little bit into Gordo's sleep period and that would wind up overlapping into my sleep period and then we would both catch a nap...Gordo's naptime which was just before Carnarvon.

Cooper I don't think we ever came over Carnarvon but what we were asleep.

Conrad The next morning we would both be asleep. ... but ... Gordo's right. The meals--if we would like to stop and talk about that. We did not even get into the left food box until the fourth day. We ate the meals that were in the footwell. There were two stowage footwells to start with and that gave us the two garbage bags that we always had out. In other words we always had two silver bags, food bags, open that we could put garbage in--any kind of garbage--and we always kept two of those out,--one on Gordo's side and one on mine. Then we'd actually collect more--we'd eat more meals, but we always ran with two of those out at least and we'd wind up with maybe two in each footwell and that's when we would restow at the end of that day. What we did was put as much of the garbage as

possible back in the right hand box. We completely emptied the right hand box at the beginning of the flight and stowed the articles around the cockpit in those red bags that we had built for the back of the seat and they really worked well. On the top of the seat. I kept two meals always stowed in the area that led to the right hand stowage box over my left shoulder. I kept my two meals there. Gordo normally kept his two down on either side of his helmet in the footwell area. We kept our garbage bags--our silver garbage bags down in there and the reason I say silver garbage bags is because those green ones that McDonnell made just didn't work at all. We never used them in the whole flight.

Cooper They are no good at all.

Conrad They tore up.

Cooper They are hard to get into. They tear. The top--the way it puckers up there you have a hard time getting anything in and out of it. I finally used one over there to fasten that camera--that 200 millimeter camera, that 35 mm camera. We put the lens down there so that it would hold--so that the

bag would hold it in. Keep it from floating and then fasten the velcro upon the back of the maneuver controller.

Conrad Now there was one thing that one green bag that I had originally had the REP plan stow in it. The REP plan was never taken out and I never took the bag off the wall. Then, the other green bag had the Poleroid light filter in. I took that light filter in and out so many times that the elastic on the top of the bag broke and the bag got completely frayed from my right leg rubbing against it. My pressure suit actually wore that cloth all through. You can see that on that bag that came out of there. So they didn't work at all. We kept all our food garbage and all that little sort of things in the silver food bags that we opened and when we filled one we would wrap it with tape and stow it down there until it was time for our daily housecleaning.

Cooper I might add for stowage two items that we found were extremely important were rubber bands and tape.

Conrad We actually ran out of tape on the eighth day packing the last of the garbage. We used every bit of tape that we could lay our hands on. We took the tape off of the bags.

Cooper And I had a whole pocketful of rubber bands.

Conrad And Gordo had a whole pocketful of rubber bands. We found that was the only way to handle the food. After we ate a rehydratable package or even a few solid packages that we opened. We always resealed them again with tape and rolled them up as small as we could get them and used the tape to wrap them with for stowage.

Cooper To keep them very small and compact.

FCSD Rep Did you get all this stuff where you originally planned to put it?

Conrad I have a copy of our reentry stowage here which shows what varied from the way it was. Now the big items, there was only one big item that didn't go. There were only two items that didn't get stowed in the place that it was called for that I remember right now. The S-1 camera went over in the right food box rather than the left food box and the urine device we kept out until the last minute and we restowed it in its original stowage place which was in Gordo's left box.

Cooper And then there were two partial bags of defecation bags and an empty bag and one bag full of about a half of a meal, paper and wrappings from one meal

that went in behind my ejection seat. I managed to work around the side and get clear down around to the back and manage to shove it down in behind the seat.

Conrad Then I had a little bit of miscellaneous trash like that in the right lower wrap around red pouch that was over the seat for reentry. It consisted of several things which we hadn't planned to stow any place. The cardiovascular cuffs that I cut off were one of them. Some loose paper trash like the top round paper ring off the defecation bags. This was just a convenient place to put light trash and I saw no reason to remove it from there. And that was about it. I forget--they'll have a list of the other items that were in there but they were all minor paper things.

Cooper Yes, I had a few pieces of paper and things in the outboard back wing.

Conrad But we pretty well had everything stowed in its proper place before reentry. Very little exception. Well, let me look right now. I marked what we had stowed in the right place. Okay, in the two left--they're called left and right food box extensions. The back ones that had the rubber covers

on them. They had originally had the--in my side the blood pressure reprogrammer, the hose interconnect adapters and the pilot's personal preference kit. Gordo's side it had just the personal preference kit and the hose interconnect, right? There wasn't anything else in there, was there?

Cooper I don't think there was.

It calls out here for a blood pressure reprogrammer but we only had one.

Cooper No, we only had the one on board.

Conrad Okay, I removed those three items and Gordo removed his two items just prior to reentry.

Cooper The hose interconnect--I had ....

Conrad Yes, that's what I said, the hose interconnect and the pilot's personal preference kit. The two kits we stowed in our leg pockets and the two hose things we stowed up in the green pouches during reentry so that they would be handy on the water to connect the hoses up. We filled those wing boxes with food trash from the last days worth of meals because we had completely filled the right hand food box with trash and we had completely filled the left food box. Let's see in the left food box we did stow the 16 mm

camera and we did stow the 17 mm lens and the 18 mm lens and the 75 mm Hasselblad. We did not stow the urine receiver there. We stowed that up where it had started out in the left side food box. We did stow the mirror sight there and we did stow the ring sight and we did stow the 18 voice tapes. Now the 18 voice tapes cartridge holder was entirely unsatisfactory. We had to take the 18 voice tapes and take them in groups of three and wrap them with tape so that we had something that was a little handier to work with than stuffing that box.

Cooper Yes, that thing is just too big.

Conrad We stowed them in groups of three in that box, but we got it all in there and the reason we didn't get anymore in was that that box was still half full of food. Matter of fact, you didn't hardly get below the level of the lid.

Cooper I got just to the bottom level of the lid.

Conrad Yes, there was a good three days worth of food left in that box. Everything else went where it was supposed to go. Except we only stowed two 16 mm film bags in the center compartment and I left two in the original right hand box because they were not exposed. We spent so much time in drifting

flight and everything that we just didn't ever shoot up the 16 mm film. There just wasn't that much to shoot it up on.

FCSD Rep How long for reentry? Starting stowage for reentry? Would you estimate?

Conrad We did it in three steps. 20 hours before reentry we started really really thinking about the big stuff. You know the thing that we thought might cause us a problem. The one place that we were worried about was getting all the stuff in the left hand box. So that's when we got to looking at the tapes. We got all the gear out that we had to stow in there including the Hasselblad and sort of got an idea how much room it was going to take in that box and that was when we decided we had to tape the cartridges. Now when I say tape 18 cartridges, heck, that shot an hour right there. I mean, you just don't do anything fast up there, and so we were ready for reentry 6 or 7 hours before reentry. We could have come in anytime, because we took care of our major items very early. Now, this doesn't mean that we couldn't afford to pull that camera gear and run experiments because all that stuff was still in the same place and we

could have laid our hands on it. We didn't actually stow the Hasselblad till the very end.

Cooper We stowed it about 4 hours.

Conrad And so we were prepared by working constantly through the night but not steadily. We worked on and off. We took little rests. Then we went back and--

Cooper To give a time estimate though for purposes of planning I would say you should figure on it taking you at least a minimum of about 4 hours to really thoroughly restow. And this depends on how messy the cockpit is. If its really messy it will take longer than that. If the cockpit is reasonably squared away and reasonably clean you should figure on it taking about 4 hours to really completely thoroughly stow everything and get ready for reentry.

Conrad Now we were really conscious all 8 days--we would say to one another, "Boy, it's time to stop and stow things right now," because the situation is getting out of hand and you'd be surprised at how fast you can build up trash in that cockpit and not realize that it is in there, you see.

Realize that if we had to reenter shortly or even if we pack it tightly, but I think the bottom of the box I think I wasted a--I'll say I could have put another silver bag or two worth of trash in there by stuffing the lower part if I had known about it in the beginning. But it didn't take us much past day 2 to realize that we had a trash problem and we had to keep on top of it every single day if we were going to ever have it cleaned up at the end. And we were in good shape. We were as clean as a whistle when we came in.

FCSD REP How about the power up?

Cooper I think that the power up went just right straight forward.

Conrad Yessir, I've the checklist right here. Just like the insertion checklist we went by the numbers and I actually marked it off as we did it and you can see it right there. I went through power off check off list and we went right down the thing we had. Our checkoff list is wrong and we had changes in it right here. We had Attitude Indicator with FDI, Computer Power-ON, Computer to PRELAUNCH, Platform-CAGE, Scanners PRIMARY, Rate Gyros-ON and it should read Attitude Indicator with FDI Rate Gyros-ON, Computer in the PRELAUNCH MODE, Computer Power-ON Platform, Scanner etc.

Cooper The arrangement of it was wrong.

Conrad Yes, the arrangement was wrong. But we did it just by the numbers right here. And it was completely straight-forward. Interesting note on the Platform, we went for many days with the platform powered down to that it got as cold soaked as it was ever going to get and the platform took the maximum time. Heat drop out took exactly 25 minutes and then it was a little slow coming in. On the cold starts it took 28 minutes to get the

attitude light. It took 3 minutes after the fast heat drop out. And then I noticed after that was the first time after we did that--powered it up two or three times why the platform came in at 25 minutes of a fast heat drop out. And then right after that it would start to cage up and you'd get the Attitude Light on and you'd be in business with the Platform, but that platform performed beautifully.

Cooper Well, I might make just one remark on the platform. Something that I thought was extremely interesting to me. People have talked about the bad platform drift and everything but we had one occasion we had our platform powered for some 18 or 20 hours.

Conrad Let's see, why did we do that?

Cooper Because they wanted us to-

Conrad Oh, it was after we tumbled up there with that OAMS check which they really didn't think out too well and they thought we might lose our gas volume.

Cooper We were about to lose the gas volume by starting to vent again so they wanted us to power up, bring the power up to a pretty high level to keep below the vent pressure on the hydrogen.

Conrad Yes, to keep the platform warmed up incase we had to-

Cooper So they wanted to keep the platform warmed up also. So we went for some approximately 20 hours with the platform warm-running-up.

Conrad In drifting flight.

Cooper In drifting flight. So what we did-we caged the platform, brought it up to cage and then we just went to orbit rate. Left it in orbit rate and we caged it at a time when were just guessing pretty close to 0,0,0 and then went to orbit rate. Some 20 hours later drifting all around,-tumbling all over the sky,-all over the places-

Conrad It was amazing how close the platform was.

Cooper The platform was almost right on what our attitude was after that many hours of orbital rate errors and drift etc. etc. added in to there and it still was a good relative attitude indicator I thought it was really good.

Conrad In all three axis it stayed on. I was pretty surprised.

Cooper I really thought that was quite good. That platform really behaved well and it really took a lot of abuse. Different times we powered it up-in drift- did all kinds of things. You couldn't have mistreated it more if you tried. Alining the platform very straightforward. We alined it in BEF. First of all, we went right to

our old platform position which was BEF and started right from there in lining in a fine line by BEF position going out just--lining from there and we found that we had quite a yaw error in it. We noted that-

Conrad That showed up in roll real fast.

Cooper So we noted then that our yaw-what we figured was our yaw star one of them that we remember as our yaw star was a little bit over to the right about 10 degrees. So we just went to cage. Eased it over about 10 degrees, uncaged it in BEF and sure enough then we went to platform position in BEF showed the needles weren't very far off. Right away they began to aline. ... very closely and we had it alined very shortly.

Conrad Yes, I can't say too much for that star chart either, boy, it was real comforting to have those yaw stars and it turned out that Scorpio went right down the middle of the tube for us. We just always knew that we had the platform in good alinement be for retrofire. We knew that we were right on in yaw all the way down that line and we could just name the stars and we knew that they were just going to come right down the middle by watching them go and it worked real well.

FCSD REP How long did you aline the platform?

Conrad — One and a half orbits. We really alined in about one and a half orbits.

Cooper — We powered up two and one half and then actually, we were actually alining for about an orbit and a half before retrofire. And we were on all the alinement and everything was done on the RCS system.

FCSD REP — How about the preretro checklist?

Cooper — Let me say this on this alining. We found that we couldn't even see any decrease at all in RCS after an orbit and a half. The way we were doing this we were doing it in Horizon Scan BEF then using the Pulse Mode in the Horizon Scan. To really keep those needles really closely centered. Now, you can do the same thing in Pulse BEF,-but the Horizon Scan if you neglect it for just a minute, the Horizon Scan would hold it in there real closely and wouldn't let you wander off anywhere in pitch.

Conrad I can't say too much for that star chart either. Boy, it was real comforting to have those yaw stars, and it turned out that Scorpio went right down the middle of the tube for us and we always knew that we had the platform in good alinement before retrofire. We knew we were right on in yaw all the way down the line, and we could just name the stars and knew that they were just going to come right down the middle of the pipe, and watch them go. It worked real well.

FCSD Rep How long did you aline the platform for retrofire?

Conrad Well, we really alined it about $1\frac{1}{2}$ orbits.

Cooper We powered up for $2\frac{1}{2}$ and we actually were alining for an orbit and a half before retrofire. All the alinement and everything was done on the RCS system. Let me say this on this alining. We found that we couldn't see any decrease at all in the RCS quantity after an orbit and a half. We were doing it in horizon scan, BEF, and then using the pulse mode in the horizon scan to give you the fine control within the horizon scan to really keep the needles closely centered. Now you can do the same thing just in pulse, but if you neglect it for just a minute, the horizon scan would hold it in there real close. It wouldn't

let you wander off anywhere in pitch and roll. You had to watch the yaw very carefully, of course, but you could concentrate on doing other things for just a few seconds time and you didn't get your errors built up into it. You still have the pulse correction within the wider band of the horizon scan. We found that little teensy little blips to make your correction -- and I don't think we were using any fuel at all.

FCSD Rep Did you get any reading on how much you did use?

Conrad I checked this morning and it's not in yet. I don't know how much fuel. We used Ring A since we powered it up at 2 orbits, over Carnarvon the first time. What I recall from the preretro checklist -- it commenced at Carnarvon one pass before reentry. In other words, we went an orbit and a half on the RCS system -- Ring A. Most of that time we were alining.

Cooper We used dual ring RCS rate command for retrofire only. Then we turned Ring B off and did the whole reentry on ring A.

Conrad Pulse.

FCSD Rep You operated Ring A all the way?

Cooper The last I saw of Ring A in the reentry, down before

we went to drogue chute out, I still couldn't see any decrease in Ring A.

Conrad Well, I'm not sure that Ring A wasn't out of fuel, somewhere around between 100 000 on down. But the other ring wasn't. I know darn well it wasn't.

Cooper What do you mean it was? It wasn't out before we put the other ring in at all.

Conrad No. I know it wasn't out before we put the other ring in.

Cooper Did you take a look at it around 100 000?

Conrad Yes. I know the thrusters were firing. It was firing.

Cooper Well, the gauge indicated it still had all kinds of fuel left in it just before 100 000.

Conrad Well, that's regulated pressure.

Cooper Yes, it's pressure.

Conrad It's not going to tell you anything in the way of fuel usage. You have to see source pressure to find out what -- we don't have that.

Cooper Well, you would --

Conrad I'm not sure that Ring A didn't run out of fuel, but if it did, it did it somewhere around the time we put the other ring on, because we never got any

oscillations or anything. The rings were firing all the time.

Cooper It never was out of fuel before we put the other one on, I'll guarantee. I know because I was sitting there controlling with it and I know that we had control.

Conrad I know that both thrusters were physically burning inside -- you know, the throats were burning when I shut the propellant off. In other words, the propellant was shut off and there was no fuel flow going to them, but both Ring A and Ring B thrusters that I could see had throat flames in them.

Cooper That's just from residual fuel.

Conrad Yes, that's what I mean. So, I had the impression that they ran all the way down, and then if Ring A did run out of fuel at all, it did it at the very end, you know. I think that you'll find that there was fuel in both RCS rings and there should have been plenty of RCS B fuel left, because we didn't even turn on RCS B until less than 70 000. We were at 50 because --

Cooper Yes.

Conrad -- Gordo put the drogue out instead of turning the ring on.

FCSD Rep Why don't we pick up on page 26?

Cooper Okay.

5.0 RETROFIRE

5.1 T_R-36 Events

Cooper — T_R-36 --

Conrad — T_R-36 is not right. There's no aft-firing thrusters verification. That's for OAMS. And there was no T_R-22 either because that was for OAMS, nor was there a T_R-13 or 12. What we had was a T_R-27 clock set over Carnarvon.

FCSD Rep — You started your event timer at T_R-27?

Conrad — That's because we changed from 122-1 to 121-1. We went right down the pre-retro checklist before that by the numbers, and we had what we call a T_R-36 which was nothing more than pick up the event timer. So we had the pre-retro checklist complete before Carnarvon. That's when they glitched us, and I'm going to complain about this one. We had a valid load in the computer and a valid T_R when we left the States on Rev 120, and I see absolutely no reason if those guys don't know what the heck our orbit is after 120 of them up there, that they had to go ahead and send a quick up-date over Carnarvon --

Cooper — Yes.

Conrad — -- I felt that screwed us. I still want to know what happened.

Cooper And we told McDivitt --

Conrad We didn't get a DCS light.

Cooper We told McDivitt when we left Houston that everything was all square and that we're going to Reentry Mode on the computer then. We did, and then at Carnarvon the CAP COM, before he even gave us a warning or asked us about anything or even checked to see what mode our computer was in, sent an up-date. Very, very poor.

Conrad He said, "I'm sending you a new load and a new T_R. Stand by." Boy, we were all over the thing trying to get it back to PRELAUNCH. I never got a DCS light on either the T_R or the load. I quizzed him and I told him I didn't think the load went in. He said, "No, the load was valid." We read out a couple of cores and checked T_R, but I don't understand why we didn't get a DCS light. Now I won't understand it because we should have gotten two DCS lights.

Cooper Yes. One for T_R and one for --

Conrad I didn't get one the first time when he sent the T_R, and I didn't get one when he sent the load. We were in the process of switching the computer to PRELAUNCH, and I think the electrons got lost in the shuffle there. I gather that they took the computer

out yesterday and that the load in it was valid. It's just that they computed the wrong place to land, in Houston, and sent the wrong load, period. Boy, that was a heck of a thing to do, and I really -- that darn DCS! I'm going to do just what I said I was going to do. If I ever fly again, I'm not going to fly with that DCS circuit breaker on. That's just exactly what I was afraid was going to happen, and they couldn't have done it at a worse time in the flight. They just absolutely couldn't have done it worse. The one thing that I had forgotten many times was putting that computer from PRELAUNCH to REENTRY. I had it underlined 50 times on the check-off list. I was going to make sure that it was in REENTRY. When they told me leaving the Cape we had a valid load and a valid T_R, I called McDivitt and I said I'm putting the computer in REENTRY. The next thing is, at Carnarvon the guy should have seen on his board that the computer was in REENTRY and should have told me instead of sending a load like he did. We moved as fast as we could when he said he was sending loads to put the darn thing back to PRELAUNCH. That really screwed us up and I'm really mad about that. That's the only gripe I have against them, but it's a major one.

Cooper Yes. It's major enought that, by golly, my recommendations exactly like Pete's. From now on my recomendation is --

Conrad That did it.

Cooper -- that the DCS circuit breaker is left in the OFF position.

Conrad Yes. The next time I ever go for the reentry and we put a valid load in the computer, I'm going to turn the DCS off so they can't screw it up again without me turning it back on.

Cooper Absolutely. Turn that circuit breaker to the OFF position.

Conrad That's right. I'd rather miss a load and go with the earlier one. I still can't believe that after 120 orbits they didn't know exactly what our parameters were for orbit. I don't even know why they needed that track over the United States the last pass. They'd been tracking us all night long. They'd been tracking us for 8 days, and they ought to know where the heck we were. If they want to do it at the last minute, then let's plan on loading the computer at Carnarvon and not load the computer at the Cape. This loading it at the Cape and then changing it again at Carnarvon has got to go.

Cooper And then saying this is your final load. Verify --

Conrad Bad news. I'm really mad about that!

Cooper Then unscheduled and everything else --

Conrad I don't blame that guy at Carnarvon because he wasn't expecting to send us a load either. I blame Houston. Houston sent it down to them at the last minute, obviously, and he was doing the best he could and he got rushed. The whole thing we wanted to do on reentry and the reason we stowed early and sat there with nothing to do was to make sure that we were never rushed. We weren't until the guy sent that load. And there we were, 27 minutes from retrofire, and I really wasn't convinced we had the right load in the computer even when we left Carnarvon. Boy, I'm really mad at that!

5.2 T_R-256

Cooper Okay. T_R-256.

Conrad Okay. I've got some recommendations. I think we ought to rewrite our T_R-256 check-off list because there are too many things that happen on it at T_R-5 and T_R-256. We changed the procedure in flight -- I knew I was going to do it that way anyhow, in that I brought up the main batteries early. I brought them on at 7 minutes. I verified the computer in

REENTRY again, of course, and squib batteries. We were already on the RCS system, so we didn't have to bring them on, but I did bring on the other ring at that point. At the 256, we wanted to go platform to ORB RATE as late as possible, so we did that after we got T_R-256 function light -- the attitude indicator light -- and that showed we had all our clocks were in sync just perfectly. There wasn't a clock in the spacecraft that wasn't in sync. The T_R was in sync with the event timer and they were in sync with our back-up watches. There was no doubt in our minds that everything in the TRS system was working right down the line and that we were working right down the line.

Cooper We went to retro attitude punched the --

Conrad Went to retro attitude, set up the whole thing for the reentry, and at T_R-1 --

5.3 T_R-1

Cooper T_R-1, SEP OAMS, SEP ELEC, SEP ADAP, four squibs on --

Conrad At T_R-30 seconds --

Cooper Arm retro. We already had that.

Conrad I've always made it a procedure to arm auto-retro at T_R-5 seconds --

Cooper Let's see -- SEP OAMS, SEP ELEC, SEP ADAP -- we did a

T_R-1. Let's see, retro rockets squib -- all four armed at T_R-30, arm auto-retros at about T_R-5 seconds --

Conrad — Yes. T_R-5. And I absolutely positively go on record that the manual retro-fire button was pushed, because I pushed it four times at one second and the COMP light went green at --

FCSD Rep — One second after auto?

Conrad — No. One second after the retros actually fired.

5.4 $\underline{T_R\text{-}0}$

Cooper — At T_R-0, spacecraft attitude was right on the money. There were no rates. Control mode was dual RCS --

Conrad — I've got a couple of comments about the retros. There's no doubt in my mind that the number 3 retro stopped firing at least a half a second before the number 4 retro started to fire.

Cooper — It sure did.

Conrad — And there was another one in there --

Cooper — There was no overlap.

Conrad — I'm pretty sure that between the second and the third, there was no overlap --

Cooper — Between 2 and 3.

Conrad — -- but they were much closer together than between 3 and 4.

Cooper Number 1 was firing and it was just tailing off when number 2 took in. It had the proper sequence on it. Number 2 had completely stopped and there was an interval there of, it seemed like, several seconds. It wasn't, but it seemed like there was a definite distinct --

Conrad Between 3 and 4 was the one that really seemed like an eternity.

Cooper There was a definite distinct separate interval there where there was no firing going on. Then 3 fired. Then there was an even longer interval in there involved and then 4 fired.

Conrad Yes. That was long enough between 3 and 4 for me to think maybe the fourth one wasn't going to fire at all.

FCSD Rep I think we ought to get some comments on the night --

Conrad Oh, we weren't even aware of it.

Cooper We had the lights up bright in the cockpit --

Conrad We went with the lights bright --

Cooper We decided we'd play it just like we did in the simulator, just like we were going to be in the simulator, you know, with all the lights up bright and not even worry about what was going on out the window. However, I did sneak a little peaky or two and you

look like you were sitting in the middle of a fire barrel. Boy! When those retros go off, the whole spacecraft's enveloped in flames -- just looks like the whole place is burning all over back there. This flame comes all the way back over the spacecraft and all the way up --

Conrad At SEP OAMS, electric and adapter, though, we didn't see much of anything.

Cooper No. I saw a flash at SEP ADAP.

Conrad I saw a little flash, but I thought maybe we'd see a lot more flashing-type flame. Actually, no big problem in that night retro, but I'll tell you one thing, you're not ever going to do it out the window.

Cooper You're never going to see anything out the window in a night retro. You're just completely enveloped in flames.

Conrad Those RCS's are firing away like mad and there's all kinds of light outside and everything, so night retro is an instrument-type thing.

Cooper It's purely instruments. If you don't have instruments, you're just not going to shoot it.

Conrad But otherwise, I don't think there was any difference.

Cooper No.

Conrad We were completely in the dark for a long time. We

didn't have a horizon for 5 minutes after retro-fire. We were in the middle of the United States before we saw the ground.

Cooper The first place we saw was White Sands.

Conrad White Sands --

Cooper Just past the terminator --

Conrad -- was the first place I saw when we came out of the terminator on the ground. Of course, by that time, we had a sort of what you might call a discernable horizon, but it was so fuzzy. There is no such thing as a horizon at sunrise, looking the other way. Looking 180 from the sun you're looking into a gray, black, fuzzy -- boy, there's no discernable horizon. You're looking at the terminator. It's not a usable horizon. I don't call it usable. We were on gauges all the way and not until we got past the Mississippi River did we get what you would really call a horizon. That's when the reentry started getting different than the ones in the simulator. The reentry was much different in ball attitudes, in that we were much steeper on the ball. We were looking at more and more white that I ever saw before. I was hard pressed -- if we didn't have the bank angle index on the ball you couldn't tell what your bank angle was.

Cooper Yes.

Conrad There was no horizon. The black part of the ball was gone. It was gone for the rest of reentry. We lost it awful early.

FCSD Rep Do you remember a point, say 400 000 feet, at what pitch angle you were on the ball?

Conrad 400 000 feet -- the trim hadn't begun to affect you too much and Gordo was at about 30 degrees.

Cooper About 30 degrees. Yes.

Conrad Yes. But he was still flying the spacecraft, just holding attitude there.

FCSD Rep Okay, how about when you hit the atmosphere?

Conrad 280 K.

Cooper At 280 K we were --

Conrad It seemed to me that's when things started to steepen up. We started to really trim up. We were beginning to get g --

Cooper By the time we got to 280 K, we were at about 50 degrees pitch, roughly -- 50 or 60 degrees on the ball. We were quite a way down. From there on, we were moving right on around on the ball.

FCSD Rep Were you able after retrofire to roll it up and put the horizon on the top of the window and hold that?

Cooper Yes, on the ball, but we couldn't see the horizon.

Conrad Yes, those lines were useless as far as the horizon on it, because there wasn't any horizon out there.

GCSD Fep You had to use the 8-ball entirely?

Cooper Yes.

Conrad That was a pure instrument retro.

Cooper You're darn right, boy. I'll guarantee you anytime you fire retros at night, you'd better have instruments because you're not going to have a visual out-the-window, because those RCS thrusters out there will just blind you.

Conrad Yes, and this talking about doing this stuff on rate needles and no ball and everything is a bunch of hog-wash. You'd better have the whole panel.

Cooper You're darn right.

Conrad Or you fire them in the daytime, with a good horizon.

FCSD Rep Let me see now. You rolled it upside down, and what did you hold? You held 20 degrees --

Cooper 20 degrees until it started trimming out. Then, I'd switch between rate and attitude. I'd just hold that attitude and when I'd see a little tiny rate creep in -- I was on single-ring pulse -- I'd just pulse that rate out. Of course, that was establishing my trim angle right there. You'd see it on the rate. You'd

see the pitch rate needle start to move just a little tiny bit. That was showing you that you weren't quite on trim. Then I'd tweek it and it would sit right there, and it would just start trimming itself out on the ball.

FCSD Rep When it trimmed out you damped the rates. You were in single-ring direct?

Cooper Well, at 400 K I went to single-ring direct.

Conrad Yes, we were in pulse --

Cooper Yes, single-ring pulse.

Conrad Single-ring pulse to 400 K --

Cooper Then I went to RATE COMMAND on the attitude control selector and took the ACME RCS switch to direct -- one to direct, the other one was to off. Then I used single-ring direct throughout the reentry, until very late when the oscillations got so rapid that I had to concentrate too much on them rather than the attitude. Then I went into ACME -- just put the RCS switch to ACME and then flew the attitude with the stick and allowed the RCS to damp the oscillations.

FCSD Rep Still one ring?

Cooper Still one ring.

Conrad We didn't go on dual-rings until below 70 000 feet.

Cooper We had the drogue out before we went on dual-rings.

FCSD Rep Was there any problem?

Conrad The thing was steady as a rock all the way.

Cooper Yes, it was beautiful.

Conrad I've been hearing 40-degree oscillations on the drogue and all that sort of stuff. The only oscallations we had on the drogue were high-frequency low-amplitude oscillations where the drogue was stable, sitting above us steady as a rock, pulsing longitudinally like this --

Cooper It squidded super-sonically for we were about 112 --

Conrad And then the shrouds --

Cooper Did you hear about the Mercury tests where the drogue was ... a few times?

Conrad The shrouds on the spacecraft had a high frequency low amplitude oscillation, but the nose was like 5 degrees, it seemed to me. It's just surprising. We were as steady as a rock as far as I was concerned.

Cooper Well, I think the whole --

Conrad The oscillation was there, but I think the --

Cooper I think the whole retrofire and reentry is so much easier than Mercury that I can't believe it. It is really a piece of cake.

Conrad — At 30 000 we shut off the propellant valves to the RCS. It was still working away merrily there trying to steady it down on the drogue. As far as I know, there was propellant in both Ring A and Ring B when we shut them down.

5.5 Retropack Jettison

Cooper — We jettisoned the retropack right in retro attitude --

FCSD Rep — You didn't see the retropack burning up or anything?

Conrad — Yes, I saw it reenter behind us but nowhere near like those guys did. It was miles behind us when I saw it.

Cooper — I thought I saw something way back there burning. I guess that was it.

Conrad — Yes. Up and on the left side of where I was looking. I saw it burn up behind us. But it was miles behind us by then. You see, it had been chasing us in the dark so we never did see it close up. We never saw anything like pump packages blowing out when we set the retros.

5.6 Communications

Cooper Communications were good throughout the whole re-entry. We went into blackout right on time.

Conrad Right on time.

Cooper Yes, just right on the second when they said we'd go into blackout. We came out just exactly when they said we would. The only thing was, when they asked us what our over-shoot or under-shoot was I'll be darn if I could tell them at that point. I sure as heck didn't know with this computer telling us one thing and yet it not doing the right thing.

FCSD Rep We'd better put the retrofire IVI readings in here.

Conrad 269 aft, 010 left, 181 down. And that comes out amazingly close to a nominal combination. As a matter of fact, it shows that we should have had about a 60 degree bank angle, and if you compensate the 60 degrees for the off-set it would have been 54 or 53--

Cooper Yes.

Cooper Almost completely nominal.

Conrad I think this chart's a handy gouge. It agrees with what the ground gave us. We didn't fly it, of course. We flew the computer, but--

Cooper Well, this is the bank angle we flew until we got cross, and down-range at 280K.

Conrad We went from full lift at 400K to 53 degrees, which was the given bank angle by the ground which we agreed to use. We went to 53 degrees until guidance came in, and it came in at 280K. The needle showed that we were high. It showed that we were very high, that we were going to over-shoot by a large distance, and--

Cooper This is the first normal indication. The computer is supposed--

Conrad ... do anything which is what you're supposed to do. We sat there to watch the trend. Nothing happened. The needle didn't come up off the peg. I looked at the high scale and it didn't look to me like the high scale was pegged out.

Cooper It wasn't pegged. I went to the high scale and it was about half way down.

Conrad Less than half way down, indicating that we were up around a 75 mile over-shoot, which just told me we were humping a little bit to get down into the target.

Cooper Right.

Conrad And, in fact, at that time we were ....

Cooper ...to get on down to it because it told me--

Conrad We were just sitting there waiting for the needle to come up like we had seen it do a million times in the same situation. It never came off the peg. Then, we got in a little discussion, you know. I felt that we ought to go to full lift because I thought something was wrong with guidance. Gordo agreed that something was wrong with guidance but he really thought maybe we really had over-shot. I'm sure the retros were on time and they were nominal, almost. So, we finally wound up going back to the nominal lift vector--

Cooper I went back to the nominal bank angle, which we had agreed we'd go to if anything happened. We had agreed with FOD that if anything happened throughout re-entry--something was wrong with guidance--

Conrad We flew--

Cooper --we would go back to the nominal bank angle, that we wouldn't take any great abnormal-type situation. We would go back to the nominal bank angle, so that in the event they lost communication with us or something screwed completely up in the reentry, they would know that we used as near as possible to the nominal bank angle.

Conrad Now, what really hurt there though was that he sat there at the nominal bank angle of 53 degrees until we got to, say, 2 1/2 g's, which is a fair long time through the guidance.... When he elected to roll to the 90 degree bank angle, that's when we were getting the most lift. Boy, we dug in-- I'll tell you we shot up there to 7 1/2 g's in nothing flat. It was at about that time that we rolled back out again, you see. We'd lost the main lift that we were going to get out of it, but, as it is, I don't think we did so badly winding up 83 miles short. I understand they were targeting 240 miles short.

Cooper That's apparently what the load they had in the computer turned out to be--erroneously put in at 240 miles short.

Conrad Yes, they were off by a factor of 240 miles.

Cooper So, if we had followed the computer exactly we'd have been a lot further shorter than we were. Fortunately, we recognized that something was amiss.

FCSD Rep Did that down-range needle ever do anything?

Conrad No, I don't think it moved at all.

Cooper I don't think it ever really moved. I think one time it moved a little, but I really don't think

it moved much.

Conrad I think we were hoping to see it move, you know, but it was just one of those--that's a fast time situation there, and it was just one of those things where we made the right decision in the end to go back to the nominal bank angle. Everything in the computer indicated--the time to 400K and roll needle initiate were within a second of one another. What the ground gave us--

Cooper And the time to 290K was exactly right.

Conrad And 280K time, roughly as far as we knew and everything--BANG! in comes the guidance initiate down-range predict on the needles. Everything up to that point--the computer had come on green, the IVI's read nominal, we saw the kind of thing we expected to see. We were completely suckered on that, because the computer worked just like it was supposed to--

Cooper And the down-range needle indicated exactly what it always will do and exactly what we'd briefed with FOD. They had agreed that what we should see on the computer is just about the maximum deflection on the low scale when it first comes on.

Conrad And that's just what we got.

Cooper Because that's exactly the way things are all set up in the math flow. You'll get that and then very shortly thereafter if you hold the nominal bank angle it will take a little bit of time and it will start easing on up.

Conrad And you'll get an idea by the rate of easing up.

Cooper If you roll to the 90, of course, in that position you'll get to it in a big rush, but you want to be careful not to overshoot.

Conrad You'll never get back.

Cooper But, then when I held the nominal bank angle and it didn't come up and didn't come up, then I rolled to the 90 to see if I was going to be able to bring it up. Of course, by this time I realized that when I didn't see it come up something was really wrong. I then went back to the nominal. Fortunately, that period that we held at the nominal is what carried us down as near as it did. The short period that we were at 90, of course, is where we were really digging in--

Conrad It cost us 83 miles, probably, because I think if we had flown the nominal bank angle all the way that we'd have really wound up real close to the darn carrier.

Cooper We'd probably wound up 45 miles from the carrier--

Conrad That going to the 90 degrees for the time period that we did cost us 80 something miles. Otherwise, we flew the nominal.

Cooper The whole thing is if we hadn't tried following the computer we would never have known

Conrad Yes, and I'll tell you one thing. I'm still convinced right now sitting in this room that computer will bring you right in to where you want to go if you have the right load in it, because it just worked magnificently. It came in just like it was supposed to and it did it on boost, too. I was really sold on it. I think the computations in that computer are accurate enough for the kind of work that a guy can do onboard the spacecraft, and it's a darn fine piece of equipment and it was working well. We're the first ones to get a good look at it and it worked just like it was supposed to. If it had the right darn parameters in it we'd have split the ship right up the middle.

Cooper I think so. I think it's just a dirty shame.

FCSD Rep What was the cross-range needle doing?

Cooper Cross-range was showing that we needed left bank in there--that we needed to move to the left. In other

words, you're flying opposite. You're flying your needle to. In other words, you're flying back course ILS on lateral and you're flying a standard ILS on the glide slope--front course ILS. The cross-range needle was showing off to the right, which indicated that we needed to bank left, which is exactly right. That's just exactly right. We hit 10 miles short. We never did get the cross-range--cross-range was coming in--cross-range did move in on us. Down-range, I don't believe, ever really moved. Cross-range did move in some on us, and that's when I went back to the nominal. I thought, well, we're past the time to reverse bank angle. Maybe I ought to roll right. So, I rolled over to the right side and said, no, by golly, I'm still going to follow the cross-range. At least it's giving us the proper indications, I believe. So, I rolled back in to the left bank, which was smart because we still hit slightly to the right. Were we off to the north or the south, Pete? I had it all figured out one time.

Cooper I don't really know Gordo. I didn't pay any attention to the cross-range needle.

Cooper Anyway, the way I had it figured out here the other

day the cross-range needle was indicating properly.

FCSD Rep The down-range needle, when it came on, stayed in the same place all the time--all the way through?

Cooper Yes.

FCSD Rep Full-scale.

Cooper Full-scale. Right. Just about full-scale on the low range.

FCSD Rep Okay. How about any of the up-dating done during reentry?

Conrad We got all the times. We got all the times just fine and I wrote them all down. They gave us enter blackout at 16:14, out of blackout at 21:20, reverse bank at 19:25, bank left 54, and bank right 68. The drogue time was 22+05, and the main time was 23+48. They were all good times. I had them all written down. No problem. They got the up-dates in before blackout and in plenty of time before blackout, as a matter of fact. We whistled right in there. No sweat on the times. I guess maybe we went to the 90 degree bank or something like that, but from about the time of 1g to the time of guidance locking out, which is roughly 100K and the altimeter coming off the peg, man, I don't know whether it was just because we did it for real

but everything else worked like the simulator timewise, but that time period seemed extremely short to me in comparison to simulator reentry.

Cooper Yes, it sure did to me.

Conrad Yes. Now we can go back and look at the times and see what the actual times were to these--

Cooper Maybe just in real time--

Conrad This might have been the real-time case to make--

FCSD Rep How about the altimeter?

Conrad It worked very poorly on lift-off. It had been very jerky and jumped all around but it was smooth as a bell. Boy, it came off the peg. It locked up at 96 000. What was it? It did it in the altitude chamber.

Cooper 96 800 feet or something like that.

Conrad It didn't ever run to 100 000 and it never had. It didn't do that in the altitude chamber, and it quit where it always quit--96 800. It came off the peg smooth and just wound right on down. No jumping or jittering.

Cooper It was right with the barostats coming down.

Conrad Yes, it was right with the barostats coming down. I called the altimeter off the peg to Gordo and he put the landing arm on, which was roughly at

100 000. Then, I said, "Stand by for 70 000." I was going to tell him to go attitude control RCS A and B to ACME, and he punched out the drogue. So, we qualified the drogue at 70 000, and then I got the rate command, both rings on, and we were somewhere below 70 000 when we put Ring B on.

6.0 REENTRY

6.1 400K

Cooper — By the time we hit 400K I was at full lift position from Retro Jett until there. Roll command gave a roll right and a roll command the bug just as it always does. Time correlation was right on the money. 400K occurred right to the second when it was supposed to. Guidance initiate occurred just at 280K at exactly the right time and it indicated we had a right .... the azimuth needle indicated right and the down range needle indicated full scale it was well up into the thing. I would say maybe half deflection.

Conrad — Yes. That was full scale. High scale was not --

Cooper — The bank angle was 53 degrees left bank which was our nominal bank angle which I went to at guidance initiate and held 53 degrees left. The rool needle at this time the roll needle indicated off full right and very shortly thereafter then .... before I even got suspicious that we weren't getting down on this, the roll needle then crossed over the middle position and held there indicating we had the right bank angle there for a minute and then crossed full scale over to the other side ....

which gave me one little old tweak of suspicion there that something was wrong right there on the roll bug. At that point then, I rolled 90 to see if I could get on that too, the down range needle. The cross range needle moved in some from the right. It had been out... not completely full scale, but quite a ways out. It moved in slightly but not much. Down range needle, let's see, I don't believe it ever moved up from there on and then at that point when I saw that the 90 wasn't going to hold it in there, I said I was going back to the nominal bank angle. I went back to the 53 but then put in 60....67 degrees bank right, to see if I can get the roll bug to change. It didn't change at that time so cross range was still indicating that I should be banked left so I went back to my bank left to see if I can kill off the cross range. I knew at that point that something was really seriously wrong and I was just trying to hold it as nominal as possible. I should have probably at that time since I was already passed the time of reverse bank angle, I probably should have gone ahead and held that, but that was a mistake, I probably should have gone ahead and held that 67 degrees bank right, and

held that on in. It probably would have corrected us out a little better cross-range-wise, but the period of time that we were at 90 degrees trying to get the glide slope, to get onto the glide slope there, is what cost us that 86 miles. Had we held the nominal bank angle all the way and ignored the computer, I think we would have hit very, very near the carrier. But, we... at least we gave the computer a try. I think that if it had had the right values loaded in it, I think it would have done very well by us. The spacecraft behaved very well. Ionization, we got into that ionic layer. After the 280K point, we began to really ionize quite a bit and got into a typical fire ball effect back there although it didn't seem to me like it was as much of a fire ball effect in this as it was in Mercury. It seemed a lot less.

6.2 Acceleration Profile

Cooper Acceleration profile, I noted the g's very early before we got the 2g's on. I noted the g's felt pretty strong in there. I could feel them fairly severe now. I never felt at all from there on. I never even felt like we had any amount of g's on us until I noted we had seven and a half and I could

hardly believe it. So, I didn't have any trouble controlling or... I just didn't think about having it on there. Pete noticed the g's more than I did because he wasn't as busy, I guess, as I was.

6.3 Spacecraft Control

Cooper Spacecraft control was beautiful. There was no problem at all. I was on single ring DIRECT and then had gone fairly late down in the guidance program there when the oscillations got to be often enough in there that it was taking a little concentration to damp the oscillations as well as to watch the guidance. I just went over the single ring ACME or RATE COMMAND ACME and let the RATE COMMAND damp the oscillations and I was doing the steering, with the RATE COMMAND also. Still single ring.

6.4 100K Feet

Cooper Let's see, at a 100K the altimeter came off the peg very shortly thereafter. I was going to arm both RCS rings, bringing on ring B to ACME at 70K and instead I deliberately, calmly, cooly, and deliberately deployed the drogue chutes. And it worked beautifully. Most stable drogue chute I ever saw. It squidded, just like a supersonic drogue test that were done in Mercury that I saw. In fact, 70 was

the point where he put the Mercury drogue out. It squidded a couple of times very nicely and stabilized out and was just beautiful....We never had any oscillations on it or anything. It was just as nice as it could be.

6.5 50K Feet

Cooper — By 50K we had both RCS rings ON, just letting them feed on out and then were blipping away out there and the spacecraft just came right straight down. No oscillation or anything.

FCSD Rep — What kind of oscillation on drogue deployment.... what would you estimate the .....

Cooper — I don't think we had any at all. I don't think we had a single oscillation really, when we deployed the drogue, do you?

Conrad — Oh yeah. It oscillated but the ..... it was sort of high frequency and low amplitude.

Cooper — That's just what I say. I mean it was just kind of like.....It was just kind of like -- a little quiver on the line. Like when you pluck a bow string, you know, the string ....the spacecraft would kind of go like this but not any amount of --

Conrad — These guys were talking about 40 degree yaw angles

and stuff like -- Nothing like that.

Cooper I bet you couldn't make it any more than 2 or 3 or 4 degrees.

Conrad Yes, I would say 5 at the most. Now I don't have any horizon or anything to reference this to. All I'm doing is watching the drogue. But I didn't have any physical sensations, or --

Cooper There were no physical sensations of any kind of oscillations.

Conrad The frequency was too high to ever get any amplitudes that big. We were just sitting there and the drogue looked steady to me, see, and all I could see was the nose and the shrouds zacking back and forth like that. Oh, sort of around, and, you know. They were both at pitch and yaw...but I felt comfortable all the time. I didn't have any idea that we were really going to --

Cooper It was well stabilized. Stable as a rock

Conrad Now, I'll tell you that RCS was really working. Now, we were in RATE COMMAND not REENTRY RATE COMMAND, we were in RATE COMMAND. So, it would. I mean, it was firing full time.

Cooper Yes, it was really working.

Conrad We were outside the rate command bands.

FCSD Rep You don't use the reentry command?

Conrad Heck no!

Cooper No, no that's useless.

Conrad We had fuel up the kazoo.

Cooper We had all kinds of fuel. We figured to just go into RATE COMMAND. That's exactly what --

Conrad ... to see how smooth a reentry you could make.

Cooper The only thing we deviated from our very carefully calculated preflight plan was that I, instead of going to dual ring RCS, I put the drogue out at 70K.

Conrad We just had that step backwards between 50 and 70K.

Cooper There must be a hold over from Mercury there somewhere, too, still getting to me.

Conrad Okay, now the next most important thing was that at 50 000 or shortly thereafter, we went to repress. Gordo turned on the REPRESS and I hit the O_2 HIGH RATE, and as we planned you know, we were not going to vent the cabin or open the inlet snorkel, and man, going through 27 000 feet that needle hit zero faster than you can say "Jack Robinson." That cabin came down from 5 psid to nothing and I said "Holy Christmas"; it came down so fast that I was really humping to get the .....I wanted to get the

vent open and I opened the vent and opened the inlet snorkel and set the recirc at 45 degrees in pretty fast order. But, all the fancy calculations by the ECS people are dead wrong, because there isn't enough in that repress or the O_2 HIGH RATE to keep up with that differential drop off. We got fumes too, but not many.

Cooper Boy, I dind't think they were hardly noticeable, at all.

Conrad It was noticeable.

Cooper Just a musty smell.

Conrad But it was noticeable. I'm sure it helped to have the O_2 HIGH RATE and the REPRESS on all the way down.

Cooper But then the one thing that we did do then at 2000. We closed it back up. Closed it back up and left the REPRESS and O_2 HIGH RATE on, so that I expect that we had a little bit of delta pressure in the cabin when we touched.

Conrad Oh, we did. We had about a pound. It was very slowly coming up.

Cooper It was up .....

Conrad We had about a pound.

Cooper Now I think this kept a lot of the fumes out.

Conrad — Then we sat there in the water, very leisurely. It was still building up. I went and cycled the O_2 HIGH RATE handle OFF.

6.6 35K Checklist Items

Conrad — Before you leave that let's just say that at 35 000 feet for the check off list we uncovered our D-rings. At 30 000 feet we turned off the RCS propellant A and B and they ran out shortly thereafter. We ....

6.7 Communications

Cooper — We... communicated with the recovery forces. Talked to them at that point twice on the way down and they asked us for a short count.

Conrad — We gave this here.

Cooper — We gave this a short count. They said "Roger, reading you loud and clear." and they had us fixed at 270 degrees at .....

Conrad — 289, I think it was.

Cooper — 289, was it? Well, some.....I know you had a degree and a bearing and a range on us at that point.

Conrad — We managed to get all the way through our post main check off list, too.

6.8 10.6K Barostat

Cooper — Then at .....the barostat came on, deployed the

drogue just as the barostat came on. It came on right at 10.6, right on the money. I punched the main, deployed the main just as the barostat came on. As we have already said, the main deployed.....

Conrad There seemed like an awful long time to me though from the time you punched the main for it to go through the sequence. It seemed like an eternity for the R and R can to blow.

Cooper Well, you could see the sequence going on out there, all this thing trundling out and all the long lines going out, and all the sequence happening, and then the main coming out.

Conrad It was really pretty though.

Cooper Well, I guess I was anticipating.

Conrad It was just like in that picture.

Cooper You see all this stuff coming out, you know, that drawing where it shows all the cycles of the stuff coming out. Just like advertised.

6.9 Main Chute Deployment

Cooper We reported when we had a drogue, when we had a good main. The main came out nominally. De-reefed exactly on time .....

Conrad Beautiful thing. No gores out, no nothing, rips or anything, nothing. It was just nominal all the way.

Cooper It was a real pretty main, and we were very stable on the main. We weren't oscillating at all, I mean obviously. It looked like we were just coming straight down.

Conrad Yes, the whole thing damped out. That is another reason the water landing was so smooth.

Cooper And when we touched in the water, as I said, we went to the 2000, we went to --

6.10 Single Point Release

FCSD Rep Okay, single point release. How about that?

Cooper Single point release. It's there. I mean it's really a jolt when you go to single point release, but being aware of it we were both braced like this when I hit it, it oscillated us a couple of times and then that is all there is to it.

Conrad You hit the end of the strap and then you see-saw a couple of oscillations. That's exactly what it felt like.....

Cooper As long as you know what to expect there is no problem. I can see why Gus and John would knock the heck out of themselves.

Conrad Not expecting it.

6.11 Blood Pressure Measurements

Cooper Okay, we gave a blood pressure at Guaymas after retrofire and I told them I wouldn't put the programer

ON until we were on the water and I gave them three blood pressures and I don't think any of them worked, I don't think the bowl bled down.

6.12 Post-Main Checklist Items

FCSD REP Okay, we got the rescue beacon without lights and the suit fans and ACME BIAS power OFF. This is post main check list and landing attitudes.

7.0 LANDING AND RECOVERY

7.1 Impact

Cooper — Impact, was very very soft. We just hit. We hit very easy. We didn't go under water at all. We didn't change attitude one bit from the time we hit the water. We went bloop.

Conrad — We just pitched down a little bit --

Cooper — The nose pitched down 8 or 10 degrees but the water didn't even come over the windows. The main hit parachute release, the chute drifted off in front just slightly out to the right of us and just sat out there in the water on the right for a long time.

Conrad — We did skip this one thing here with this 6.13 post main check off list. We got all the way through that and I wanted to say that I had the decided impression that we got to the post main and got back over here on this 2000 foot check list pretty fast. I mean that time happened faster than the simulator but it took us a little while to get our heads unlocked, and after we went to 2-point and get back on this check-off list, and boy, we hadn't any more gotten through this when we were

over there to the 2000 K and I was ....

Cooper One thing that took a little bit of our time there though, Pete, was the fact that the AIR BOSS called us twice there and we were actually busy answering that.

Conrad We were talking on the radio and a little talking to Houston on the radio too.

FCSD REP Why don't you talk a little bit more about the 2000 foot that pressurized in the cabin.

Conrad Yes, well then we went the D-ring safety cover. We covered our D-rings but I can't put my D-ring pin in so I didn't put the pin in until we were on the water. I can't put that pin in, in flight, strappen in the seat. I can't reach down there. Gordo, can. Gordo can reach down and get it. I can't do it. So, I didn't put mine in. Then I went to cabin vent UP and inlet snorkel UP and then left the recirc valve at 45 degrees, and of course the repress had been on since 50,000. So had the O_2 HIGH RATE, or some altitude shortly thereafter. The cabin seemed to be coming up very slowly. It doesn't even with repress on. That's a, I guess, a lot of volume in there or something, but it just doesn't come up fast. So we were about a pound when

we landed.

FCSD REP Never got over a pound?

Conrad Never got over a pound I don't believe.

Cooper Then we came OFF on the repress and we opened our face plates.

Conrad Then we opened our face plates and took a sniff in there. It didn't smell to bad. I had a little smell of RCS fumes. Now mind you we were sealed off at 2000 so I know it didn't come in on the water. The RCS fumes that were in there came in there at 27000 when we opened the vent and the inlet snorkel so I'm still -- if the structure would take it, I really think you should come in and leave that inlet snorkel and that vent closed. If you did that you would have a clean, cold cabin when you hit the water. Okay, now.

Cooper I didn't really think it was as objectionable.

Conrad No, it wasn't objectionable.

Cooper It was cool. One thing we might add right here right now, that we didn't cover back in the pre-retro area was that we went the full cold on everything. We had that cabin so cold, and we went to cabin fan and so that the cagin was about, what, 40 degrees, 50 degrees.

Conrad No, the cabin was about 53 degrees. Somewhere in there. It was a little over 50, and the suit was running ....

Cooper The suit was running about 50 on reentry so the whole thing was pretty cool.

Conrad It was never hot at any time.

Cooper When we opened our face plates the cabin was still cool, the suits were still cool, and the snorkel and vent when we did open them and both fans came on after we went OFF of O_2 HIGH RATE, Repress and both fans came on. We were getting nice cool air through .... Yes, we have been hearing everybody say, you know, boy you've got to get those suits off, you really get hot in there. You see and Gordo said "Well come on we are going to be here for awhile, we'll get the suits off" and it was perfectly obvious that we were getting a good flow and I said "Well, why don't we put our neck dams on and we'll leave the inlet snorkel open here and get this fans running and see, just see, just sit here for a second, because you get awful hot getting out of the suit period. And by golly we were in good shape. We could have stayed in that

spacecraft 2, 3 hours. As a matter of fact the longer we stayed the cooler we were getting because we were just sitting back letting --

Cooper We really debated seriously about waiting if the carrier had been an hour or so nearer we would have waited for a carrier pick up rather than go with the choppers.

Conrad Because we were in good shape in there and we didn't feel bad and the smells weren't bad and what little RCS fumes where in there from picking them up at 27000 went right out.

Cooper Of course we had -- let's face it though, we had an ideal day on the water. It was like a mill pond out on the water. It was nice and smooth and sunny and everything was in good shape, with the spacecraft.

Conrad It was early in the morning and the air was about 80 degrees - air that it was pulling in the aircraft pumping in our suits, see. But we were in good shape.

7.2 Checklists

Cooper Check list. I thought our check lists were very good with a few minor things we have mentioned

here that we might ... we would suggest maybe reshuffling a little there.

7.3 Communications

Cooper The communications were excellent all the way, all the way down until impact and from there on we were hearing everybody in the whole darn world but nobody apparently was hearing us.

Conrad Now, Houston read us twice on the water, but ....

Cooper Houston read us twice.

Conrad We transmitted both on UHF and we transmitted on HF.

Cooper Our HF antenna never did extend on the water. They don't know whats wrong with it at this point, but we went through the right procedures several times of extending it. Point of impact, we found out fairly shortly what our point of impace was by hearing the discussion in the air on where it was. Status of recovery. We were kept well informed of that because our radio receivers were working fine.

7.4 Systems Configuration

Cooper Systems configuration, ECS was excellent. No problem at all. Electrical was good, control was good, aeromedical -- what does aeromedical have to

do with it here?

FCSD REP Biomed records and all that stuff.

Cooper The gear worked. The one thing was, the blood pressure bulb wouldn't bleed down and Pete never could get a proper blood pressure there when on the water.

Conrad I took the bulb up to the helicopter and gave it to the doctor and told him to check it right away and find out what happened because it worked fine all flight.

7.5 Spacecraft Status

Cooper Spacecraft status. There was a faint odor of fumes in there but I didn't personally consider them objectionable at all.

Conrad It cleared out once we got the fans running.

Cooper Main chute was excellent. The windows -- visibility was doggone good out the windows ... we were fogged over just a little bit.

Conrad They steamed up a little bit. I could see out of them all right and could see the airplanes flying overhead.

Cooper They steamed up a little bit. After we sat there they steamed up more than they were when we first landed and they .. but we could see outside very

well and I guess the guy outside probably couldn't see in as well as we could see out. They were fogged a little. There were no leaks that we could tell. Electrical Power, everything was nominal. O_2 was fine.

Conrad Electrical power, we,we, we, did not power down the squib betteries after we got on the water and we went through the landing check list and powered down all electrical equipment except the radios and the beacons and a biomed recorders and the blood pressure.

Cooper We took a complete power down check list. We followed check list right on the money. Sea condition was 2 to 3 foot easy swells.

7.6 Post Landing Activity

Cooper Post landing activities. Let's see, we proceeded to continue to try and contact and answer somebody. We heard all the activity around and over and around us. The first thing we finally heard in the way of communications was when one of the swimmers plugged in this outside phone jack and talked to us. He wasn't real clear but he was coming through pretty well. He wanted to know if we

wanted to wait on the carrier or if we wanted a chopper pick up. I asked him how far the carrier was away and he went ahead and told us about 75 miles at that time. We told him we believed we wanted to take the choppers.

7.7 Comfort

Cooper Comfort was fine in the spacecraft.

FCSD REP How long were you in the spacecraft in your suit?

Conrad 35, 40 minutes.

Cooper About 35 or 40 minutes I ... Maybe a little bit more.

7.8 Recovery Force Personnel

Cooper Recovery force personnel and communications. As I say they did communicate with us with the telephone. First of all one of the swimmers came up and looked in the window and held up his thumb and we held up our thumbs okay, so that took the sweat off them. Floatation collar, they had slightly more trouble than usually getting it around but not a great deal. It probably took them maybe 10 or 15 minutes to get it around there and inflated.

7.9 Egress

Cooper Right after they got it inflated we told them we were coming out for the chopper. I opened the left

side hatch. We did have our ...we saw that they had the floatation collar around there and the sea was calm and there was no problem getting any water in the spacecraft and we decided we weren't going to go in the water ourselves. We did have our neck dams on but we did not have our gloves on. We left our helmet and gloves in the cockpit and decided well if we did go in the water for unforecast reason we had our water wings and our wrists are tight enough to hold your arms above water and not get much in.

7.10 Survival Gear

Cooper So, we didn't fiddle with any survival gear or anything.

7.11 Crew Pick Up

Cooper We just stood out on the nose of the spacecraft. In fact ...then I moved from the nose over into one of the liftrafts. Pete came up out of the hatch and stood on the nose and he took the first ...horse collar came around. He got the horse collar and went up to the chopper first and they lowered it again and I went in behind him.

FCSD REP Oh, one thing we didn't mention here. How about cutting the chute, the main chute?

Conrad Oh, you mean jettison? Gordo jettisoned about 1 second after we touched down.

Cooper About 1 second after we landed I hit it and away it went.

Conrad It sat right there beside us and floated around for quite a while.

Cooper It sat there about 30 yards off to the front and slightly to one side of us.

RCSD REP Okay.

3
10
21
25
33
36
38
44 ←
55 ←
57 RISP SEP
72
81

HF + VHF noise over China
Late rit. OK @ 40K + 10.6 K
Pickled drogue @ 70K rather than deval RCS
Time interval between last 3 retros
Network wired wrong catching one reentry
Time for cage = 25 min
Poor cockpit Cond. N.G. for orbiting reentry
shade parabolic mirror
Reticle storage N.G. on map
2 or 3 more revs to change
Diurnal sleep cycle difficult
Need airlock for 7
Guard for O-head handles
Guns R/O headband N.G.
Timer on water gun?
4 rehydratable bag failures
Harness to restrictive (no life vest in flt.)
POGO REPORT
Scanner - comp. check after plate alive
Nose view in AIDS
O2 spring force too high
ECS O2 vent caused hi torque

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